MOBILE RADIO

MAINTENANCE MANUAL

UNIVERSAL TYPE 99 TONE DECODER

TYPE 99 TONE DECODER
19D417257G1

SPECIFICATIONS *

Combination Numbers	2-Tone	4-Tone
Mobile	V22	V24
Station	V42	V44
Tone Frequencies	517.5 to 997.5 Hz	
Tone Input	20 Millivolts to 10 Vrms	
Voltage Requirements		
Mobile	13.8 V ±20%	
Station	120 VAC, 50/60 Hz	
Current Drain		
Standby	20 Milliamperes	
Decode	125 Milliamperes	
Alert	250 Milliamperes	
Temperature Range	-40°C to +70°C (-40°F to 158°F)	

*These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

GENERAL ELECTRIC

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WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS.

High-level RF enery in the transmitter Power Amplifier assembly can cause RF burns. KEEP AWAY FROM THESE CIRCUITS WHEN THE TRANSMITTER IS ENERGIZED!

DESCRIPTION

General Electric Type 99 Decoders are Solid State sequential tone decoders for mobile and station applications. The decoders will operate with encoders providing two-tone sequential signaling. These include the General Electric Type 99 Encoders (100, 400 and 900 Call Encoders and Dial Page Terminals).

The mobile decoders are supplied in a compact housing that is equipped with a mounting bracket for installation in 12-volt vehicles. Station decoders are supplied with a larger housing which contains a 120-volt AC power supply. The power supply provides a 13.8 VDC source for the decoder.

The decoder is assembled on a single printed wiring board containing four IC's (excluding Versatone networks) and associated discrete components. Two Versatone networks are used for decoders with two tone capability and four Versatone networks are used in decoders with four tone capability. The same component board is used in both mobile and station applications. The IC's are:

U1401 - Threshold Detector
U1402 - Frequency Switchable Selective Amplifier (FSSA)
U1403 - Control
U1404 - Four Tone Search
FL1401 thru
FL1404 - Versatone networks.

OPERATION

Operating controls for the decoders are located on the front panel. The controls include a RESET button, a CALL lamp and an alarm selector switch (LIGHT-OFF-HORN).

The basic decoder provides a visual front panel indication and two transistor switches to ground to operate an externally connected horn or light relay. The selector switch on the front panel selects the horn or light circuit for operation.

When a properly tone coded call is received, A- is provided to the CALL indicator (LED) and to the light relay circuit. These are latched functions and remain latched until the decoder is reset. Pressing the RESET button removes A- from the CALL indicator and light relay circuit.

In addition, a timed ground closure is supplied to the external horn relay during receipt of the second decode tone. The duration of this closure may vary from 0.5 to 3 seconds depending upon whether the decoder is a two-tone or four-tone decoder.

OPTIONS

Options for the Mobile and Station Decoders include a Sounder, Speaker Muting, and a Universal Extension Cable.

Sounder (Option 4066)

The Sounder option provides an alert tone occurring during receipt of the second decode tone. As with the horn relay it is a timed alert tone consisting of short bursts of tone. The volume of the alert tone is fixed.

Speaker Muting (Option 4065)

The speaker muting option mutes receiver audio when calls are not being received. When calls are received, relay K1401 activates and transfers the speaker audio from muting resistor R1409 to the speaker.

Universal Extension Cable (Option 4093)

The universal extension cable allows increased mobility of the Decoder.

CIRCUIT ANALYSIS

FOUR-TONE OPERATION

In 4-Tone Decoders the Control IC controls the resistor OR gates in the 4-Tone Search IC that select the Versatone networks. The active Versatone network determines the tone frequency that the Frequency Switchable Selective Amplifier (FSSA) responds. A free running flip-flop (FF) in the 4-Tone Search IC alternately enables two pairs of OR gates: 1, 2 and 3, 4 to complete the search of all four possible tone combinations. Tone combinations decoded are: A1-B1, A1-B2, A2-B1 and A2-B2.

References to symbol numbers mentioned in the following text are found on the Schematic Diagram, Outline Diagram, and Parts List. Refer to the Troubleshooting Procedure for a block diagram of the Type 99 Decoder.

The 2nd tone switch in the Control IC provides 5.0 V to "B" resistor OR gates 2 and 4 in the 4-Tone Search IC via pin 14. Since a positive voltage on either input of the resistor OR gates prevents selection of the associated Versatone network, the "B" tones are not selected.

At the same time, the 1st tone switch in the Control IC provides A- to "A" resistor OR gates 1 and 3 in the 4-Tone Search IC via pin 10. Thus, when the free running FF alternately applies A- to OR gate pairs 1, 2 and 3, 4 only the OR gates associated with the "A" tones are enabled. As each "A" tone gate is enabled A- is applied to

the associated Versatone network. This allows the FSSA to respond to that tone frequency.

The input tone (taken from speaker hi) is applied to the Threshold Detector IC. The tone is limited and applied to pin 12 of the FSSA. If the tone corresponds to the selected Versatone network, the FSSA applies the tone to the Threshold Detector IC. After receiving the tone from the FSSA, the Threshold Detector provides 4.7 V to pin 5 of the 4-Tone Search IC. This turns on the FF lock circuit and stops the free running FF. This voltage is also applied to the 2nd tone search timer, the 1st tone clamp and the "B" input of the decode gate in the Control IC. The 4.7 V sets the timer; however, the 1st tone clamp prevents it from starting its 1.5 second run until the "A" tone ends.

The decode gate requires A- on its "A" input and 4.7 V on the "B" input before it will provide the timed output. When the decode gate receives the "B" input voltage from the Threshold Detector IC, the decode gate is still disabled by the "A" input from the 2nd tone switch.

At the end of the "A" tone, the 2nd tone search timer initiates a 1.5 second run enabling the 2nd tone switch to provide A- to pin 14 of the 4-Tone Search IC, the 1st tone switch, and the "A" input of the decode gate in the Control IC. The input from the 2nd tone switch causes the 1st tone switch to apply 5.0 V to the 2nd tone clamp, and to pin 10 of the 4-Tone Search IC. This disables OR gates 1 and 3 in the 4-Tone Search IC. The 2nd tone clamp disables the 1st tone clamp in the Control IC.

The FF lock unlatches and starts the free running FF again but now the free running FF, alternately applies A- to resistor OR gates 2 and 4. These gates, controlling "B" tone selection, operate in the same manner as described above for the "A" tone selection.

When a proper second tone is received, the FSSA applies the tone to the Threshold Detector. The Threshold Detector provides 4.7 V to pin 5 of the 4-Tone Search IC. This turns on the FF lock and stops the free running FF.

The 4.7 V is also applied to the "B" input of the decode gate in the Control IC. If the "B" tone occurs within 1.5 seconds of the "A" tone, the "A" input of the decode gate will remain at A- due to the clamping action of the 2nd tone switch. A- applied to the "A" input of the decode gate and 4.7 V at the "B" input causes the decode gate to provide a timed output to the relay driver.

The decode gate turns on the decode latched gate and the timed output to provide 5.2 V at pin 11 and 1.2 V at pin 12 of the Control IC. The output of the decode latched gate turns on relay driver transistors Q1401 and Q1402 and LED indicator CR1406. The output voltage from the timed output turns on relay driver transistors Q1403 and Q1404.

TWO-TONE OPERATION

Two-tone operation uses two Versatone networks and limits the number of tone paths to one, A1-B1. Except for a different jumper arrangement that alters the operation of the 4-Tone Search IC, operation of the 2-Tone Decoder is the same as the 4-Tone Decoder described above. In 2-tone operation a DA jumper wire is present between H15 and H16 and locks the free running FF. With the free running FF locked, OR gates 1 and 2 are continuously enabled; thus, the 1st tone switch in the Control IC selects only the A1 Versatone via OR gate 1 and the 2nd tone switch selects only the B1 Versatone via OR gate 2. With this strapping arrangement, then, only one tone combination, A1-B1, is decoded. Typical diagrams of the Versatone Network, Threshold Detector, Control, and 4-Tone Search IC's are provided in Figures 1 thru 5.

FREQUENCY SWITCHABLE SELECTIVE AMPLIFIER (FSSA)

The FSSA is a highly stable active bandpass filter operating over 288.5 Hz to 1433.4 Hz frequency range. The selectivity of the filter is shifted across the bandpass frequency range by switching Versatone networks in the filter circuit.

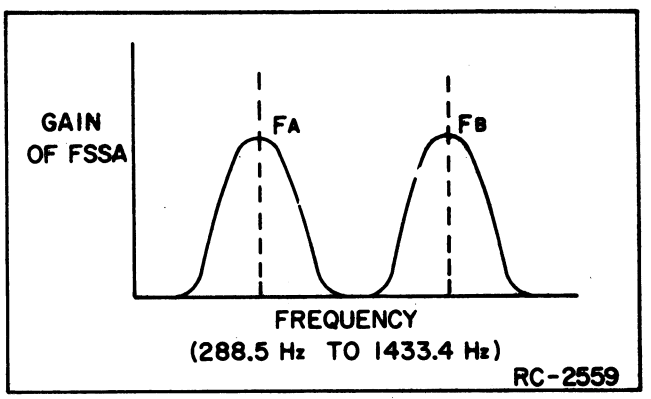


Figure 1 - Gain Vs Frequency

In Figure 1 the gain of the FSSA is shown as a function of tone frequency. The tone frequency is determined by the tone network connected in the FSSA circuit. When tone network A is in the circuit, the maximum gain occurs at Fa. When tone network B is in the circuit, the maximum gain occurs at Fb.

TONE NETWORKS

Versatone Networks FL1401 through FL1404 are parallel connected, precision resistors. A typical Versatone network is shown in Figure 2. Pin 5 of the network is connected to ground. When a positive signal from the 4-Tone Search IC is applied to pin 3, Q1 will conduct. This disables amplifier Q2 and feedback resistors R1, R2 and R3, effectively removing the network from the FSSA circuit.

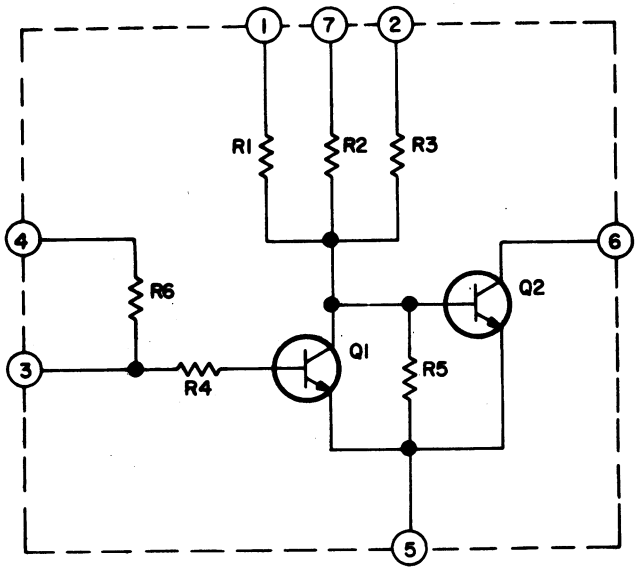


Figure 2 - Typical Versatone Network

THRESHOLD DETECTOR IC

Initially, the 4-Tone Search IC is searching between tone networks A1 and A2. When either of the correct tones is received and applied to the input of the FSSA, it will appear at the output of the FSSA at a higher signal level than other signals. The FSSA output is coupled through C1404 and R1404 to pin 1 of the Threshold Detector IC.

Receiver audio is applied to pin 7 of the Threshold Detector IC through associated coupling and attenuation networks providing the proper signal level to limiter Q4. Limiter Q4 sets the input level to the FSSA at 42 millivolts peak-to-peak. The output of the limiter is taken from U1401-5 and connected to U1402-12 on the FSSA. A typical Threshold Detector IC is shown in Figure 3.

Amplifier Q1 amplifies the tone before it is coupled to the base of Q2. If the tone is correct, the signal amplitude will be sufficient for Q2 to conduct. Q2 conducting causes DC switch Q3 to conduct applying 4.7 V to pin 6 and to pin 2 of the Control IC and pin 5 of the 4-Tone Search IC.

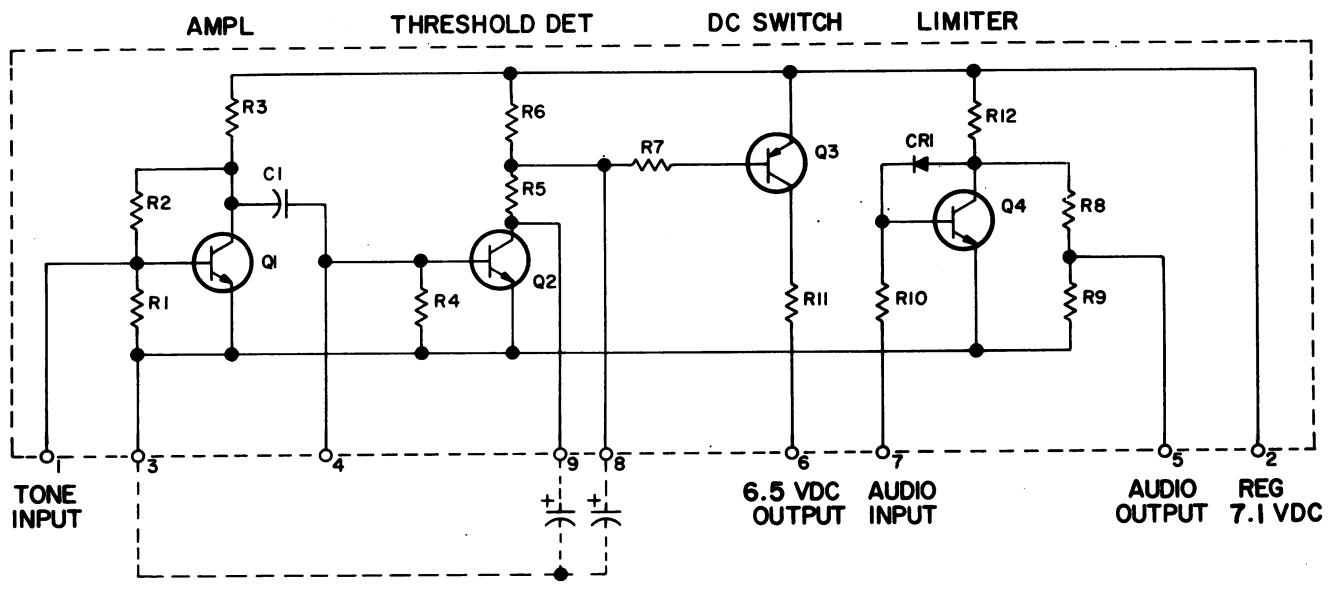


Figure 3 - Typical Threshold Detector Circuit

FOUR-TONE SEARCH IC

The 4-Tone Search IC, shown in Figure 4, alternately switches Versatone networks, FL1401 and FL1402 or FL1403 and FL1404, into the FSSA circuit. Inputs from the Control IC determine if the anticipated tone is an "A" or a "B" tone. The free running FF selects the individual tone network.

The resistor OR gates inhibit the selection of a tone network when a positive voltage is present on either input. Both inputs must be near A- to activate the associated tone network.

Before an "A" tone is received, A- is present at pin 10, and 5.0 V at pin 14 of the 4-Tone Search IC and the FF alternately selects "A" tone networks FL1401 and FL1402.

When a tone is received, the voltage applied to pin 5, causes FF lock transistor Q2 to conduct. Q2 stops the free running FF from switching while the tone is present.

After the first tone ends, the Control IC applies 4.7 V to pin 10 and A- to pin 14 of the 4-Tone Search IC. The FF lock releases the free running FF which then alternately switches "B" tone networks FL1403 and FL1404 into the FSSA circuit.

Q4 is a fast FF lock circuit, controlled by the Threshold Detector IC. When a tone is present, Q4 conducts, instantly stopping the FF. This insures the Control IC time to react.

CONTROL IC

The input voltage from the Threshold Detector (applied to pin 2 when a 1st tone is received) causes 1st tone clamp transistor Q2 to clamp 2nd tone switch Q3 off and charges timing capacitor C1414. A typical diagram of a Control IC is shown in Figure 5. When the 1st tone ends, the input voltage is removed from pin 2, turning Q2 off. C1414 now in a charged state, causes 2nd tone switch Q3 to conduct. Q3 conducting causes the 4-Tone Search IC to search for a "B" tone. Q3 also turns 1st tone switch Q4 off, causing the 4-Tone Search IC to stop searching for an "A" tone. Q4 also turns 2nd tone clamp transistor Q1 on. Turning Q1 on holds 1st tone clamp transistor Q2 off.

If a second tone is not received within 1.5 seconds, timing capacitor C1414 will discharge and automatically reset the circuit to receive a new first tone.

If a second tone is received, the emitter of Q5 is held low by Q3, causing Q5 to

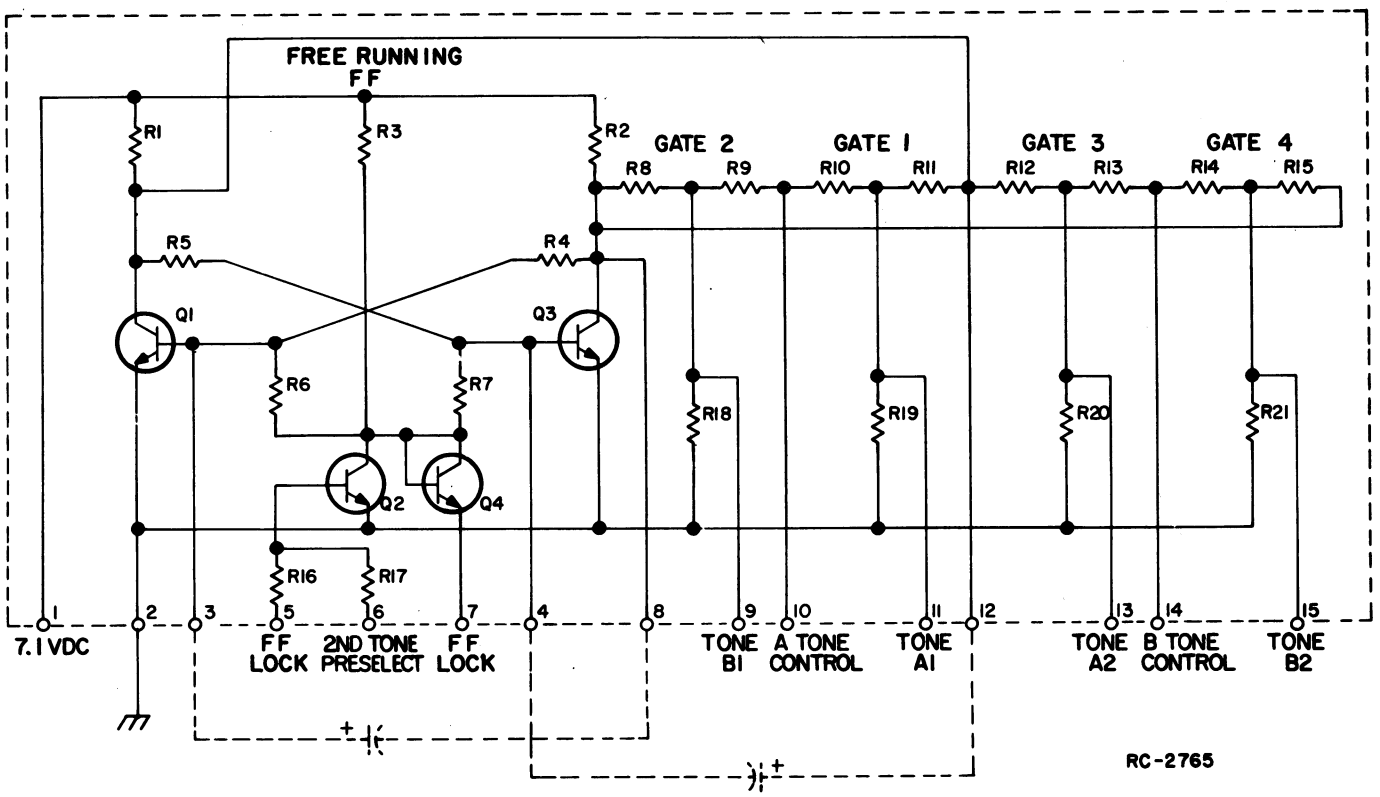


Figure 4 - Typical 4-Tone Search IC

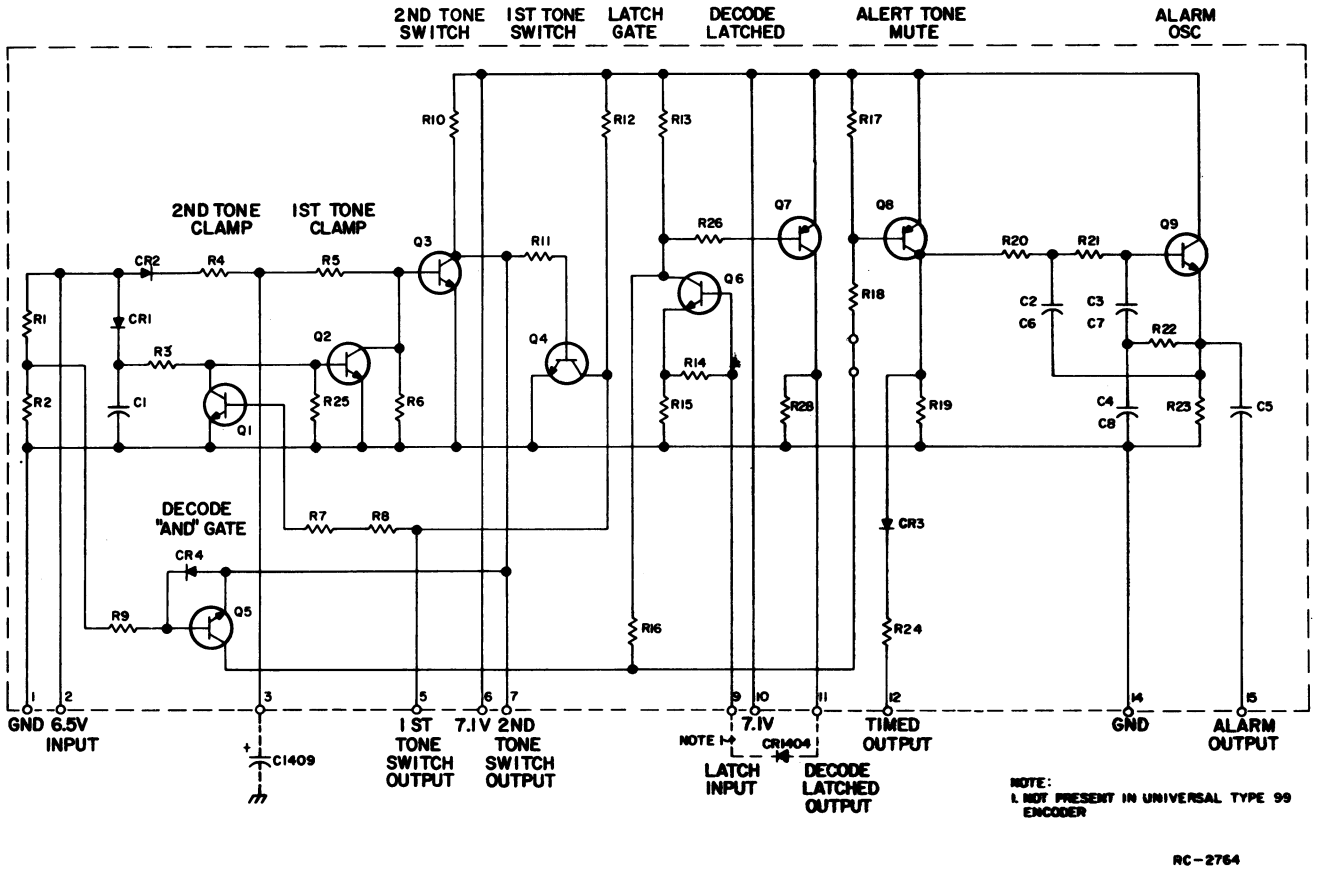


Figure 5 - Typical Control IC

conduct. Q5 causes alert tone mute transistor Q8 to conduct and provide a timed decode output to external horn and light relay driver transistors Q1403 and Q1404. These transistors provide a ground to an externally connected horn and light relay via selector switch S1401. Q1404 also operates the sounder option when used. Q5 also causes audio latch transistors Q6 and Q7 to conduct, and provide a latched decode output to relay driver transistors Q1401 and Q1402.

When the second tone ends, the FF in the 4-Tone Search IC will start and the timing circuit in the Control IC will reset the decoder to receive a first tone.

Relay driver transistors Q1401 and Q1402 will remain latched until latch transistors Q6 and Q7 are reset. When a hookswitch is not used, the latch transistors are reset manually via RESET switch S1402. If a hookswitch is used the latch transistors are automatically reset via Q1405.

LATCHED OUTPUT

When a valid tone sequence is decoded 5.2 V is present at pin 11 of the Control IC and turns on relay driver transistors Q1401 and Q1402. Q1402 provides a ground return path for CALL indicator CR1406 causing it to turn on. A ground return is also provided to an external light relay through S1401. S1401 controls operation of the external horn and light relay. A maximum of 0.5 amperes can be drawn through Q1402.

TIMED OUTPUT

When a valid tone sequence is decoded 1.2 V is present at pin 12 of the Control IC and turns on transistor switch Q1403 and Q1404. Q1404 provides a ground return path for the external horn relay through S1401. A maximum of 0.5 amperes can be switched by Q1404.

HANDSET/HOOKSWITCH

The decoders may be operated with or without a hookswitch. When the hookswitch is present, the decoder is reset automatically via the transistor reset switch Q1405 each time the handset is taken off hook. Removing the handset removes A- from the base of Q1405 and allows it to turn on. This applies A- to pin 11 (latched output) of the Control IC causing the decoder to reset. The decoder may also be reset using the manual RESET switch.

When the hookswitch is not used a DA jumper wire is present between J1424 (A-) and J1423. This applies A- to the base of automatic reset transistor Q1405 holding it off and preventing it from resetting the decoder. The decoder now must be reset manually by momentarily depressing RESET switch S1402.

AC POWER SUPPLY

A 120 Volt AC, 50/60 Hz power supply provides +13 V to operate the transistor switch, relay driver, LED and sounder in the station decoder.

Connecting P501 to a voltage source applies 120 VAC to the primary of stepdown transformer T501. The AC voltage developed across the secondary windings of T501 is rectified by full-wave bridge rectifiers CR501 through CR504. The rectified output is filtered by C501 and regulated by VR501 and Q501. The +13 V output is connected to J1430 (A+) and J1431 (A-).

5.4 VOLT REGULATOR

Zener diode VR1401 regulates the 13 V input down to 5.4 volts through R1405. The 5.4 V output is used to operate all IC's.

SPEAKER MUTING OPTION 4065

The speaker muting option consists of relay K1401. K1401 contains two sets of contacts, one to unmute the speaker when a valid tone sequence is received and the other to provide a ground return path for the external light relay circuit. Relay driver transistors Q1401 and Q1402 operate relay K1401 and CALL lamp CR1406. Refer to the Outline Diagram for required circuit modifications.

SOUNDER OPTION 4066

The sounder operates under control of the timed output of the Control IC. When a valid tone sequence is received the timed output at pin 12 applies 1.2 V to the base resistor of transistor switch Q1403 and Q1404 for the duration of the 2nd tone. Q1404 turns on and provides a ground return for the sounder, allowing it to operate.

The sounder contains an oscillator, multivibrator and speaker. Refer to the Schematic and Outline diagram. Q3 and Q4 comprise a multivibrator with a nominal operating frequency of 8-10 Hz. The multivibrator modulates oscillator Q1 and Q2 to provide an alert tone to speaker LS1. The volume is fixed and the sounder operates only during receipt of the second decode tone.

INSTALLATION

HANDSET HOOKSWITCH

Refer to the Installation diagram to install the microphone handset/hookswitch.

MOBILE DECODER

The Mobile Decoder operates from a 13.8 V source and should be mounted where it will be within convenient reach of the operator, and where it will not interfere with the save operation of the vehicle. Using the mounting bracket as a template, mark and drill pilot holes with a #29 (9/64-inch) drill. Attach the bracket to the mounting surface with the two #10 x 5/8-inch self tapping screws provided.

STATION DECODER

The Station Decoder operates from a 120 VAC, 50/60 Hz source, and should be located so the control cable will reach the station.

OPTIONS

Options to the Type 99 Decoders include the Sounder and Speaker Muting Options. Refer to the appropriate Service Outline for jumper wire locations.

Sounder Option 4066

To install the Sounder in the decoder refer to Installation Diagram 19C320672.

Speaker Muting Option 4065

The speaker muting option can be installed to provide latched or timed operation.

For latched relay operation make the following circuit modifications and install relay socket XK1401.

1) Clip out DA jumper wires connected between:
   H21 - H22 ☐
   H19 - H24 ☐
   H17 - H18 ☐

For timed relay operation make the following circuit modifications and install relay K1401 in relay socket XK1401.

1) Clip out DA jumper wires connected between:

H21 - H22
H19 - H24
H17 - H18
H4 - XK1401-4

2) Install DA jumper wire from H23 to XK1401-4.

FIELD MODIFICATIONS

As shipped from the factory, the standard four-tone decoder paths: A1-B1, A1-B2, A2-B1 and A2-B2.

The decoder can be field modified to provide:

1) Pre-determined signaling paths

2) Two-tone operation

3) Speaker Muting

4) Handset Hookswitch

The Standard two-tone decoder can be modified to provide:

1) Four-tone operation with or without pre-determined signaling paths.

2) Speaker Muting

3) Handset/Hookswitch

PRE-DETERMINED SIGNALING

Predetermined signaling permits the user to limit the Type 99 tone receive paths to A1-B1 and A2-B2. To provide two signaling paths rather than four; 1) clip out the DA jumper wire connected between H11 and H12 and 2) install a DA jumper wire between H8 and H11.

TWO-TONE OPERATION

Two-tone operation requires only two Versatone networks and limits the number of tone paths to A1-B1.

For two frequency operation connect a DA jumper wire between H15 and H16. Be sure the two Versatone networks are installed in socket XFL1401 (Tone A1) and XFL1403 (Tone B1).

FOUR-TONE OPERATION

To connect a two-tone decoder for four-tone operation, 1) clip out the DA wire connected between H15 and H16 and 2) install two additional Versatone networks in tone sockets XFL1402 and XFL1404.

TRANSISTOR SWITCH LOCKED TO RESET SWITCH

This mode is exclusive of Option 4065 Speaker Muting and assumes that a hookswitch is <u>not</u> used.

1) Remove K1401

2) Connect jumper wire between H21-H22; H19-H24; J1423-J1424.

MAINTENANCE

To remove the chassis for servicing, remove the four screws in the back of the decoder and pull the chassis out of the housing. Refer to the voltage readings on the Outline Diagram for troubleshooting the decoder.

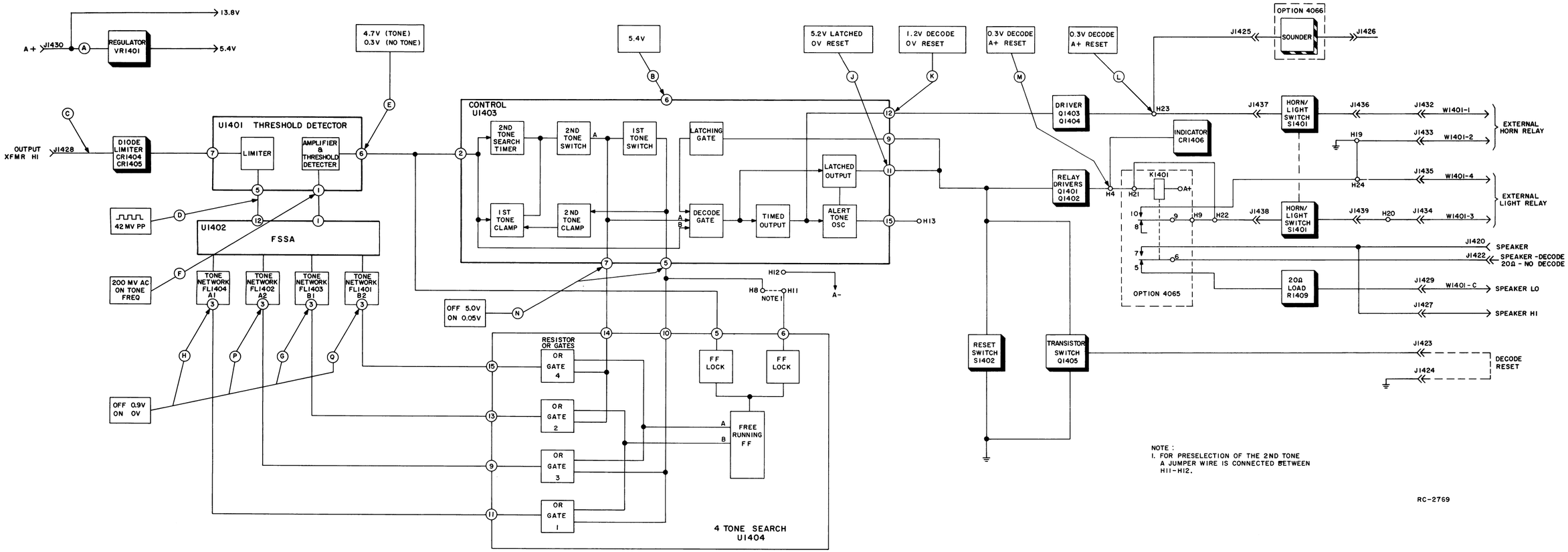
TROUBLESHOOTING PROCEDURE

SYMPTOM	STEP	TEST POINT	ACTION
Unit does not decode (Note 1)	1		Connect U1404-4 to ground. This stops the free running FF and allows the decoder to be checked as a two-tone decoder. Tone networks A1 and A2 may be switched for maintenance purposes.
	2	(A)	Check for +13.8 V (battery) between J1430 (A) and J1431.
	3	(B)	Check for +5.4 V (B).
	4	(C) (D)	Apply correct Type 99 tone to J1428 (C) at a level sufficient to cause limiting at (D). Approximately 100 mV.
	5	(E)	Check for 4.7 V.
	6	(F)	If (E) is incorrect check for 200 mVAC.
	7	(G) (H)	If FSSA appears to be defective, before replacing check: 1) XFL1401 for proper contact 2) Versatone switching voltages at (G) and (H) 3) Replace FL1401 (may be interchanged with FL1402)
	8	(E)	If the switching voltages at (G) and (H) are incorrect, connect pin 3 of FL1401 to ground. Remove FL1403. Repeat step 5.
	9	(G) (H)	If 4.7 V is present at (E), monitor the switching voltages at (G) and (H) with no tone and then a continuous "A" tone. Remove tone and verify that voltages at (G) and (H) reverse for approximately 1.5 seconds. If this sequence is correct proceed to step 10. If the switching voltages are incorrect, check: 1) XFL1403 and replace FL1403 2) 4.0 V across C1414 during the "A" tone. If no voltage replace C1414. If still no voltage replace U1403. 3) Check for shorts on U1403. 4) Replace U1403.
	10	(K)	If the response at (E) is correct, a decode indication (1.2 V) should be present at (K) during the second tone. If decode does not occur replace U1402.
	11	(J) (K)	Check performance at (J)(K). Replace U1403 if either test point fails to respond properly.
Horn/Sounder fails to operate	12	(L)	Check Q1403 and Q1404
Indicator CR1406 fails to operate	13	(J) (M)	Check for 5.2 V at U1403-11. Check Q1401, Q1402, CR1402 shorted.

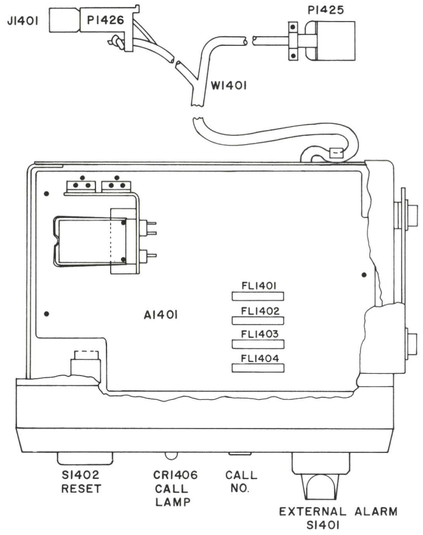
Note: Tone networks may be checked by substitution.

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

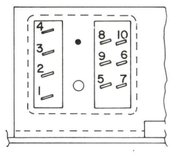
GENERAL ELECTRIC


13.8V
A+ J1430
A
REGULATOR VR1401
5.4V
4.7V (TONE)
0.3V (NO TONE)
E
5.4V
B
5.2V LATCHED OV RESET
J
1.2V DECODE OV RESET
K
0.3V DECODE A+ RESET
M
0.3V DECODE A+ RESET
L
OPTION 4066
SOUNDER
J1425
J1426
C
OUTPUT XFMR HI
J1428
DIODE LIMITER CR1404 CR1405
U1401 THRESHOLD DETECTOR
LIMITER
AMPLIFIER & THRESHOLD DETECTER
CONTROL U1403
2ND TONE SEARCH TIMER
2ND TONE SWITCH
1ST TONE SWITCH
LATCHING GATE
1ST TONE CLAMP
2ND TONE CLAMP
DECODE GATE
TIMED OUTPUT
LATCHED OUTPUT
ALERT TONE OSC
H13
DRIVER Q1403 Q1404
INDICATOR CR1406
H23
J1437
HORN/ LIGHT SWITCH S1401
J1436
J1432
W1401-1
EXTERNAL HORN RELAY
H19
J1433
W1401-2
RELAY DRIVERS Q1401 Q1402
H4
H21
K1401
A+
J1435
W1401-4
H24
EXTERNAL LIGHT RELAY
42 MV PP
D
U1402
FSSA
H22
J1438
HORN/ LIGHT SWITCH S1401
J1439
H20
J1434
W1401-3
J1420
SPEAKER
J1422
SPEAKER -DECODE 20Ω - NO DECODE
200 MV AC ON TONE FREQ
F
TONE NETWORK FL1404 A1
TONE NETWORK FL1402 A2
TONE NETWORK FL1403 B1
TONE NETWORK FL1401 B2
H12
H8
H11
NOTE 1
A-
OPTION 4065
20Ω LOAD R1409
J1429
W1401-C
SPEAKER LO
J1427
SPEAKER HI
OFF 5.0V ON 0.05V
N
RESISTOR OR GATES
OR GATE 4
OR GATE 2
OR GATE 3
OR GATE 1
FF LOCK
FF LOCK
FREE RUNNING FF
A
B
RESET SWITCH S1402
TRANSISTOR SWITCH Q1405
J1423
DECODE RESET
J1424
OFF 0.9V ON 0V
H
P
G
Q
4 TONE SEARCH U1404
NOTE :
1. FOR PRESELECTION OF THE 2ND TONE A JUMPER WIRE IS CONNECTED BETWEEN H11-H12.
RC-2769

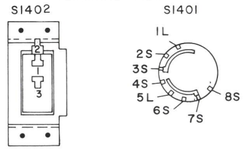
MOBILE DECODER



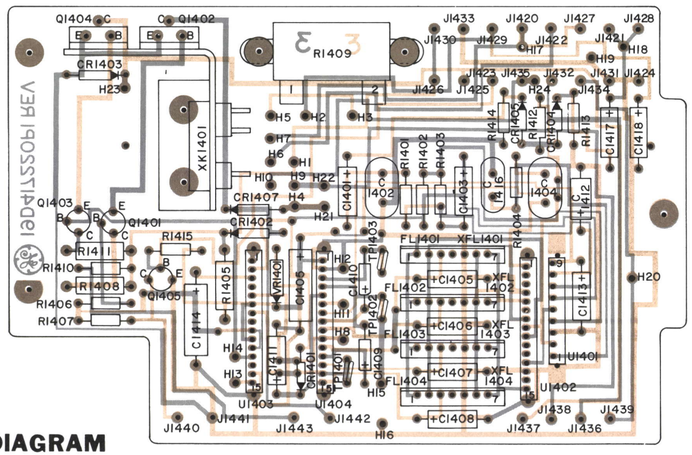
TERMINAL VIEW
XK1401



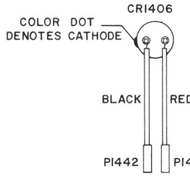
TERMINAL VIEW



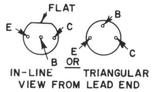
A1401



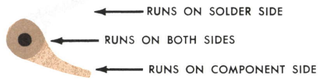
LEAD IDENTIFICATION
CR1406



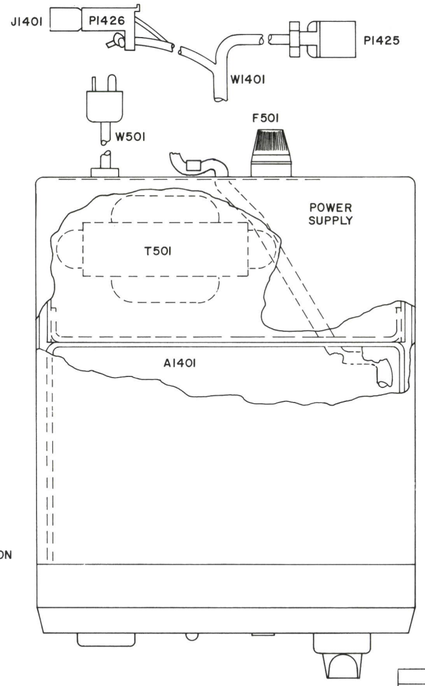
LEAD IDENTIFICATION
FOR Q1401,Q1403, & Q1405



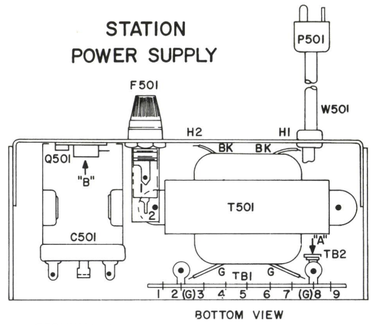
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMING FACTOR FOR LEAD IDENTIFICATION.



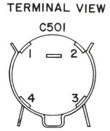
STATION DECODER

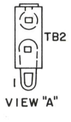


STATION POWER SUPPLY



TERMINAL VIEW





CONNECTION CHART

OPTION	CONNECTION REMOVED	CONNECTION ADDED
Basic Unit - 2 Tone (Mobile)	None	H15-H16
Basic Unit - 4 Tone (Mobile)	None	None
Basic Unit - 2 Tone (AC)	None	H15-H16 (See Option 4066)
Basic Unit - 4 Tone (AC)	None	(See Option 4066)
Option 4065 Speaker Muting	H17-H18	None
Option 4066 Sounder (Standard in AC Version)	None	Rd Wire-J1426 Bk Wire-J1425
Option 4092 Hookswitch for M.L. Mic. (Not for use with MASTR II)	J1423-J1424	None
Option 4093 Extension Cable	None	None
Option 4094 Hookswitch for Handset (Not for use with MASTR II)	J1423-J1424	None
Option 9023 M.L. Mic. and Hookswitch (MASTR II only)	J1423-J1424	None
Option 9025 Handset and Hookswitch (MASTR II only)	J1423-J1424	None

(19B226364, Rev. 3)

OUTLINE DIAGRAM

MOBILE AND STATION TYPE 99
TONE DECODERS

(19D423277, Rev. 2)
(19D417220, Sh. 2, Rev. 3)
(19D417220, Sh. 3, Rev. 3)

(19R622056, Rev. 8)

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG = 1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF = MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH = MILLIHENRYS OR H = HENRYS.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO

MODEL NO	REV LETTER
PL19C320658G1	A
PL19D417257G1	

NOTES:

1. FOR TWO FREQUENCY OPERATION, "DA" WIRE JUMPER IS CONNECTED BETWEEN H15 AND H16.
2. WHEN 2ND TONE IS NOT PRESELECTED, A DA JUMPER IS CONNECTED BETWEEN H11 AND H12. WHEN 2ND TONE IS PRESELECTED, A DA JUMPER IS CONNECTED BETWEEN H11 AND H8.
3. FOR SPEAKER MUTING K1401 IS PRESENT AND A DA JUMPER BETWEEN H17 AND H18 IS REMOVED. FOR NO SPEAKER MUTING A DA JUMPER IS CONNECTED BETWEEN H17 AND H18. NOTE 5 ALSO APPLIES.
4. FOR A LATCHED RELAY DRIVER TRANSISTOR OUTPUT TO THE EXTERNAL LIGHT CONNECTION, DA JUMPERS ARE CONNECTED BETWEEN H21 AND H22 AND BETWEEN H19 AND H24.
5. FOR A LATCHED RELAY OUTPUT TO THE EXTERNAL LIGHT CONNECTION, K1401 IS PRESENT AND DA JUMPERS BETWEEN H21 AND H22 AND BETWEEN H19 AND H24 ARE REMOVED.
6. FOR A TIMED RELAY OUTPUT TO THE EXTERNAL LIGHT CONNECTION, K1401 IS PRESENT AND DA JUMPERS BETWEEN H19 AND H24 AND BETWEEN H21 AND H22 ARE REMOVED. A DA JUMPER BETWEEN XK1401 - PIN 4 AND H4 IS REMOVED, AND A DA JUMPER IS CONNECTED BETWEEN XK1401 - PIN 4 AND H23.
7. WHEN A HOOK SWITCH IS NOT USED, A JUMPER IS CONNECTED BETWEEN J1423 AND J1424 AND BETWEEN J1421 AND J1422.

SCHEMATIC DIAGRAM

MOBILE AND STATION TYPE 99 TONE DECODERS

Issue 3

PARTS LIST

LBI4876B

TYPE 99 DECODER 19D417257G1
AND
ASSOCIATED ASSEMBLIES

SYMBOL	GE PART NO.	DESCRIPTION
		TYPE 99 DECODER 19D417257G1
A1401		DECODER BOARD 19C320658G1
		- - - - - - - - - - - CAPACITORS - - - - - - - - - -
C1401	5496267P217	Tantalum: 1.0 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C1402	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C1403	5496267P227	Tantalum: 0.33 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C1404	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C1405 and C1406	5496267P213	Tantalum: 2.2 µf ±10%, 20 VDCW; sim to Sprague Type 150D.
C1407 and C1408	5496267P217	Tantalum: 1.0 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C1409 and C1410	5491674P45	Tantalum: 4.7 µf ±10%, 6 VDCW; sim to Sprague Type 162D.
C1411*	19B200240P15	Tantalum: 1.8 µf ±5%, 20 VDCW.
		Earlier than REV A:
	5496267P213	Tantalum: 2.2 µf ±10%, 20 VDCW; sim to Sprague Type 150D.
C1412	5491674P40	Tantalum: 10 µf ±20%, 20 VDCW; sim to Sprague Type 162D.
C1413	5496267P228	Tantalum: 0.47 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C1414	5491674P37	Tantalum: 10 µf ±20%, 10 VDCW; sim to Sprague Type 162D.
C1415	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C1416	7489162P43	Silver mica: 470 pf ±5%, 300 VDCW; sim to Electro Motive Type DM-15.
C1417	5496267P217	Tantalum: 1.0 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C1418	5496267P228	Tantalum: 0.47 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
		- - - - - - - - - DIODES AND RECTIFIERS - - - - -
CR1401	19A115250P1	Silicon, fast recovery, 225 MA, 50 PIV.
CR1402 and CR1403	4037822P1	Silicon, 1000 MA, 400 PIV.
CR1404 and CR1405	19A115250P1	Silicon, fast recovery, 225 MA, 50 PIV.
CR1407	4037822P1	Silicon, 100 MA, 400 PIV.
		- - - - - - - - - - TONE NETWORKS - - - - - - - - -
		NOTE: When reordering give GE Part Number and specify exact frequency needed.
FL1401 thru FL1404	19C320291G2	Hybrid: 517.5-997.5 Hz.
	19C320291G3	Hybrid: 288.5-1433.4 Hz.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1420 thru J1443	4033513P14	Contact, electrical: sim to Bead Chain R40-4AA.
		- - - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1401	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q1402	19A116118P1	Silicon, NPN.
Q1403	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q1404	19A116118P1	Silicon, NPN.
Q1405	19A115910P1	Silicon, NPN; sim to Type 2N3904.
		- - - - - - - - - - RESISTORS - - - - - - - - - - -
R1401	3R152P102J	Composition: 1K ohms ±5%, 1/4 w.
R1402	3R152P185J	Composition: 1.8 megohm ±5%, 1/4 w.
R1403	3R152P104J	Composition: 100K ohms ±5%, 1/4 w.
R1404	3R152P203J	Composition: 20K ohms ±5%, 1/4 w.
R1405	3R77P471J	Composition: 470 ohms ±5%, 1/2 w.
R1406	3R152P103J	Composition: 10K ohms ±5%, 1/4 w.
R1407	3R152P100J	Composition: 10 ohms ±5%, 1/4 w.
R1408	3R77P221J	Composition: 220 ohms ±5%, 1/2 w.
R1409	5496941P24	Wirewound: 20 ohms ±5%, 15 w; sim to Tru-Ohm Type MOR-15.
R1410	3R152P102J	Composition: 1K ohms ±5%, 1/4 w.
R1411	3R77P221J	Composition: 220 ohms ±5%, 1/2 w.
R1412	3R152P333J	Composition: 33K ohms ±5%, 1/4 w.
R1413 and R1414	3R152P202J	Composition: 2K ohms ±5%, 1/4 w.
R1415	3R152P223J	Composition: 22K ohms ±5%, 1/4 w.
		- - - - - - - - - - TEST POINTS - - - - - - - - - -
TP1401 thru TP1403	19A134552P1	Spring. (Test Point).
		- - - - - - - - - INTEGRATED CIRCUITS - - - - - -
U1401	19C320539G1	Threshold Detector Limiter.
U1402	19D417092G1	Selective Amplifier.
U1403	19D417098G1	Control.
U1404	19D417132G1	4 Tone Search.
		- - - - - - - VOLTAGE REGULATORS - - - - - - -
VR1401	4036887P5	Zener: 500 mW, 1.5 PIV.
		- - - - - - - - - - - SOCKETS - - - - - - - - - - -
XF1401 THRU XF1404	19C320299G1	Includes:
	19D416714P1	Socket.
	19B219681P1	Contact.
XK1401	5491595P4	Relay: 10 contacts; sim to Allied Control 30054-1.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1406	19A130106G1	Diode, red light emitting.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1401		(Part of W1401).
		- - - - - - - - - - - - PLUGS - - - - - - - - - - -
P1424 thru P1435		(Part of W1401).
		- - - - - - - - - - - SWITCHES - - - - - - - - - -
S1401	19A129831G2	Rotary: 1 section, 2 poles, 3 positions, non-shorting contacts, 2 amps at 25 VDC or 1 amp at 110 VAC; sim to Oak Type A.
S1402	19A129841G1	Push: SPDT, 10 amp at 125 or 250 VAC; sim to Micro Switch 13DM1-B1.
		- - - - - - - - - - - CABLES - - - - - - - - - - -
W1401		CABLE ASSEMBLY 19B204739G1
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1401	5492497P24	Plug: sim to AMP 480134-1.
		- - - - - - - - - - - - PLUGS - - - - - - - - - - -
P1425	7489183P10	Plug: 9 contacts rated at 7.5 amps max; sim to Winchester M9P-LS-H19C.
P1426	5492497P14	Plug: sim to AMP 480135-1.
P1427 thru P1435	4036634P1	Contact, electrical; sim to AMP 42428-2.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A116022P1	Insulator, bushing. (Used with Q1402 and Q1404).
	19A116023P3	Insulator, plate. (Used with Q1402 and Q1404).
	19A130013P1	Insulator. (Used with U1401).
	19C311848G2	Chassis.
	19B205054P2	Front cap.
	19A121880P1	Support. (S1402).
	19A116677P1	Bushing. (CR1406).
	NP276470	Nameplate.
	19B205111G2	Knob. (S1401).
	19B209209P308	Tap screw, Phillips Pozidriv®: No. 6-32 x 1/2. (Secures Front Cap to Chassis).
	19B209209P204	Tap screw, Phillips Pozidriv®: No. 4-40 x 1/4. (Secures S1402 support).
		ASSOCIATED ASSEMBLIES
		SOUNDER OPTION 19A129489G2
		- - - - - - - - - - LOUDSPEAKERS - - - - - - - - -
LS1	19A116090P1	Permanent magnet: 2.00 inch, 8 ohms ±10% voice coil imp, 450 Hz ±112 Hz resonant; freq range 400 to 3000 Hz.
		SOUNDER BOARD 19C320785G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - - -
C1	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C2 and C3	5491674P44	Tantalum: 2.2 µf 20%, 15 VDCW; sim to Sprague Type 162D.
C4	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1 and CR2	19A115250P1	Silicon, fast recovery, 225 MA, 50 PIV.
		- - - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q2	19A115562P2	Silicon, PNP.
Q3 and Q4	19A115910P1	Silicon, NPN; sim to Type 2N3904.
		- - - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R152P473J	Composition: 47K ohms ±5%, 1/4 w.
R2	3R152P182J	Composition: 1.8K ohms ±5%, 1/4 w.
R3	3R152P223J	Composition: 22K ohms ±5%, 1/4 w.
R4 and R5	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R6	3R152P223J	Composition: 22K ohms ±5%, 1/4 w.
R7	3R77P470J	Composition: 47 ohms ±5%, 1/2 w.
R8	3R152P331J	Composition: 330 ohms ±5%, 1/4 w.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	4036634P1	Contact, electrical; sim to AMP 42428-2. (Hung in wiring from H1 and H2).
	19B219776P1	Insulator. (Located under component board).
	4036555P1	Insulator, washer: nylon. (Used with Q2).
	N404P13C6	Lockwasher: No. 6. (Secures Sounder board to support).
	N80P13010C6	Machine screw: No. 6-32 x 5/8. (Secures Sounder board to support).
	7141225P3	Hex nut: No. 6-32. (Secures Sounder board to support).
	19B204583G2	Hinge. (Located nearest control face).
	19B204583G3	Hinge. (Located away from control face).
	19B209209P305	Tap screw, Phillips Pozidriv®: No. 6-32 x 5/16. (Secures hinges to decoder).
	19B201074P205	Tap screw, Phillips POZIDRIV®: No. 4-40 x 5/16. (Secures Sounder board to hingers).
	19C320662P1	Support. (Sounder Kit locates on this support).
	7150186P109	Spacer: No. 6-1/8. (Located under Sounder board).
	N80P13005C6	Screw: No. 6-32 x 5/16. (Secures Sounder option to decoder case).
	NP243580	Decal, Call Numbers.
		STATION POWER SUPPLY 19C311855G1
		- - - - - - - - - - - CAPACITORS - - - - - - - - - -
C501*	7476442P23	Electrolytic, twist-prong: 2000 µf +250-10%, 50 VDCW; sim to PR Mallory FP070A.
		In REV A and earlier:
	7770994P28	Electrolytic: 500-500 µf -10% + 200%, 25-25 VDCW; sim to Mallory Type WP.
C502*	19A115680P24	Electrolytic: 400 µf +150% -10%, 18 VDCW; sim to Mallory Type TTX. Added by REV B.
C503*	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW. Added by REV B.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR501 thru CR504	4037822P1	Silicon, 1000 MA, 400 PIV.
		- - - - - - - - - - - - FUSES - - - - - - - - - - -
F501*	7487942P3	Slow blowing: 1/2 amp at 250 v; sim to Bussmann MDL-1/2.
		In REV A and earlier:
	7487942P1	Slow blowing: 1/4 amp at 250 v; sim to Bussmann MDL-1/4.
		- - - - - - - - - - - - PLUGS - - - - - - - - - - -
P502 and P503	4036634P1	Contact, electrical; sim to AMP 42428-2.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q501*	19A116742P1	Silicon, NPN.
		In REV B:
	19A116118P1	Silicon, NPN. Added by REV B.
		- - - - - - - - - - - RESISTORS - - - - - - - - - -
R501*	3R152P151J	Composition: 150 ohms ±5%, 1/4 w.
		In REV B:
	3R77P221K	Composition: 220 ohms ±10%, 1/2 w.
		In REV A and earlier:
	5496941P23	Wirewound: 16 ohms ±5%, 15 w; sim to Tru-Ohm Type MOR-15.
		- - - - - - - - - - - TRANSFORMERS - - - - - - - - - - -
T501	5493743P1	Power: step down: Pri: 117 v, 50/60 Hz, Sec 1: 12.6 v ±3%, 2 amps.
		- - - - - - - - - TERMINAL BOARDS - - - - - - - - -
TB1	7775500P25	Phen: 7 insulated, 2 grounded terminals.
TB2*	7775500P44	Phen: 2 terminals. Added by REV B.
		- - - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR501*	19A115528P6	Zener: 1 Watt, 17.6 v max. Added by REV B.
		- - - - - - - - - - - CABLES - - - - - - - - - -
W501	19A116740P2	Power: 3 conductor, approx 8 feet long; sim to Belden 17239.
		- - - - - - - - - - - SOCKETS - - - - - - - - - - -
XF501	19B209005P1	Fuseholder, post type, phen: 15 amps at 250 v; sim to Littelfuse 342012.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A134016P1	Insulator, bushing. (Used with Q501).
	19A116023P1	Insulator, plate. (Used with Q501).
	19A116768P8	Strain relief. (Used with W501).
		SPEAKER MUTE KIT 19A130158G1
	5491595P12	Relay, armature: 1.5 w operating, 520 ohms ±15% coil res, 2 form C contacts; sim to Allied Control T154-X-186.
	5491595P8	Retainer: spring; sim to Allied Control 30040-1.

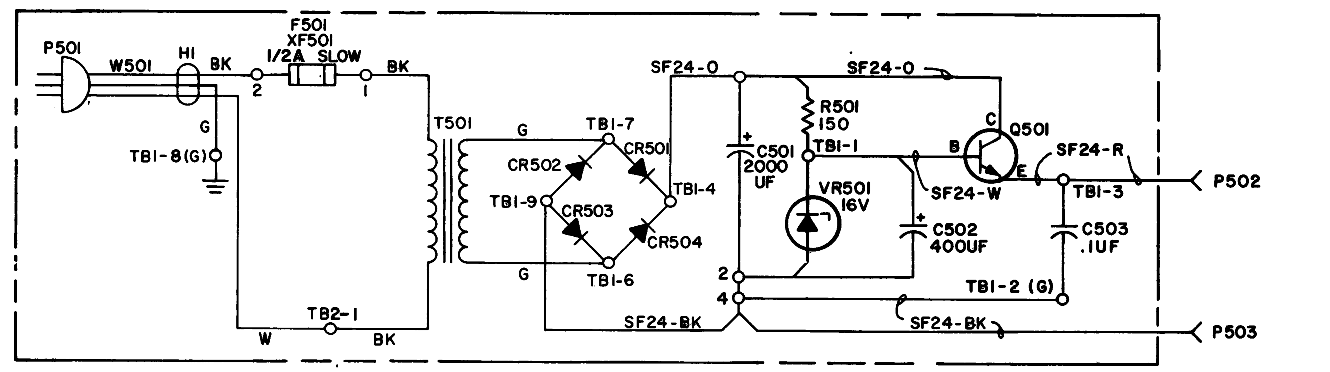
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - Power Supply 19C311855.
Incorporated in initial shipment.

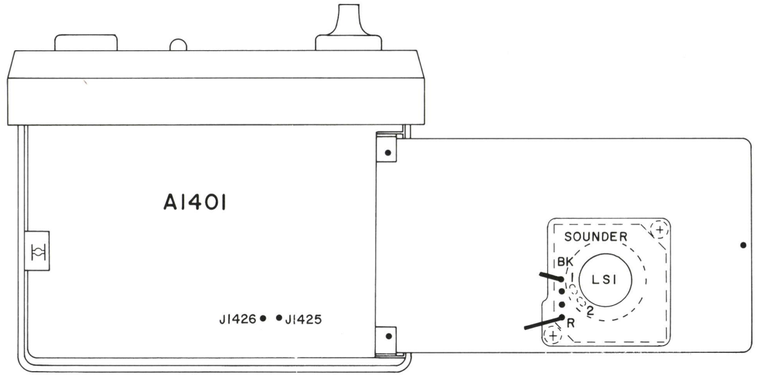
REV. B - To improve operation. Changed C501, F501 and R501. Added C502, C503, Q501 and VR1.

Old Schematic was:

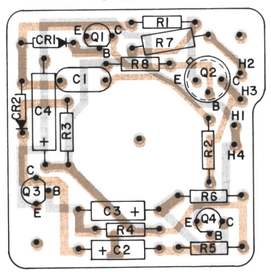


REV. C - To improve regulation. Changed Q501 and R501.

REV. A - Decoder Board 19C320658G1.
To improve operation. Changed C1411.

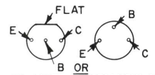


SOUNDER BOARD



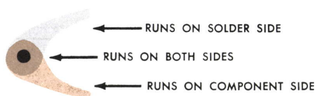
(19C321600, Rev. 0)
(19C320784, Sh. 2, Rev. 2)
(19C320784, Sh. 3, Rev. 2)

LEAD IDENTIFICATION FOR Q1, Q2, Q3, & Q4

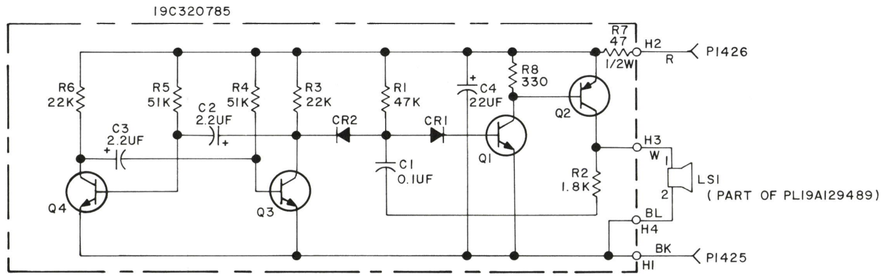


IN-LINE VIEW FROM LEAD END — TRIANGULAR VIEW FROM LEAD END

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.



SOUNDER OPTION

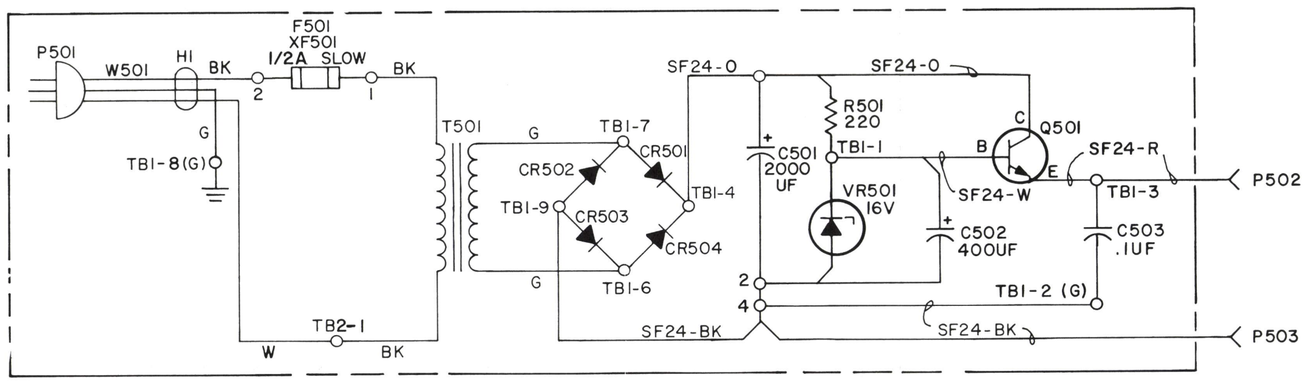


(19B226115, Rev. 6)

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
19C320785G1	

POWER SUPPLY



SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
19C311855G1	B

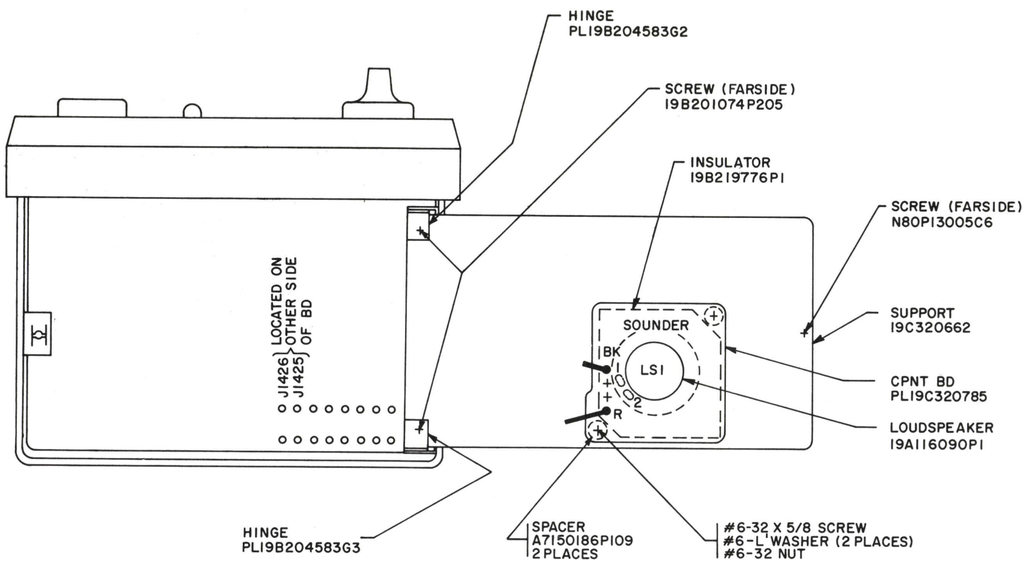
ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

SCHEMATIC & OUTLINE DIAGRAM

STATION POWER SUPPLY & SOUNDER OPTION

SOUNDER OPTION



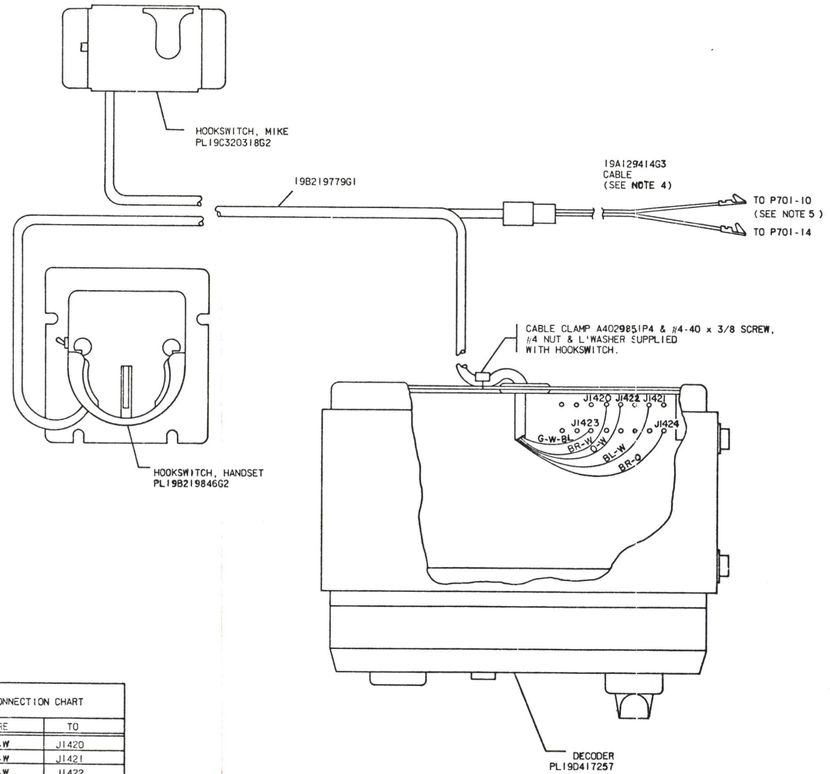
(1) THESE INSTRUCTIONS COVER INSTALLATION OF MODIFICATION KIT I9AI29489G2

INSTRUCTIONS:

1. REMOVE DECODER FROM CASE.
2. ASSEMBLE BOTH HINGES WITH I9B209209P305. (4 PLACES)
3. SOLDER SOUNDER BOARD WHITE WIRE TO LSI-1 AND BLUE WIRE TO LSI-2. KEEP SOLDER CONNECTIONS MINIMUM SIZE.
4. MOUNT SPEAKER, INSULATOR AND SOUNDER BOARD USING SPACERS AS SHOWN.
5. CONNECT RED WIRE AND BLACK WIRE ON COMPONENT SIDE OF DECODER BOARD PER CONNECTION CHART I9B[illegible].
6. CLOSE HINGED ASM. AND SECURE WITH SCREW.
7. REASSEMBLE DECODER IN CASE.

(19C320672, Rev. 4)

DECODER HOOKSWITCH



CONNECTION CHART	
WIRE	TO
BR-W	J1420
BL-W	J1421
O-W	J1422
G-W-BL	J1423
BR-O	J1424

INSTRUCTIONS

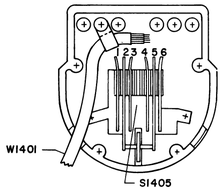
1. REMOVE DECODER FROM CASE.
2. REMOVE JUMPER BETWEEN J1423 AND J1424.
3. ROUTE CABLE AS SHOWN AND CONNECT AS SHOWN IN CHART.
4. USE I9AI29414G3 CABLE SUPPLIED WHEN REQUIRED FOR CG DISABLE. CONNECT TO P701-10 & P701-14 ON MASTR II CONTROL UNIT.
5. WHEN USED WITH CUSTOM MVP AND CHANNEL GUARD, REMOVE CONTACTS FROM CABLE (4144G3) AND REPLACE WITH TWO CONTACTS SUPPLIED. CONNECT TO P1-6 & P1-8.

(19C320494, Sh. 4, Rev. 4)

INSTALLATION DIAGRAM

MICROPHONE/HANDSET HOOKSWITCH

OUTLINE DIAGRAM



(19B232602, Rev. 0)

PARTS LIST

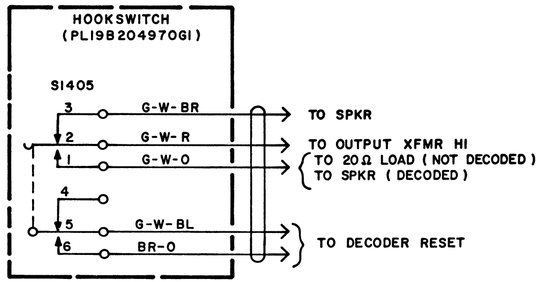
LBI30667

MICROPHONE HOOKSWITCH 19C303571G1
AND
HANDSET HOOKSWITCH 19B204970G1

SYMBOL	GE PART NO.	DESCRIPTION
		MICROPHONE HOOKSWITCH 19C303571G1
		- - - - - - - - - - SWITCHES - - - - - - - - - -
	19B209099P1	Pressure sensitive: SPDT, 10.1 amp at 125 VAC; sim to Cherry Electrical Products E62-10A.
		- - - - - - - - - - - CABLES - - - - - - - - - -
W1704	19B204731G1	Cable: approx 50 inches long.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P1720 thru P1724	4036634P2	Contact, electrical: sim to AMP 42429-2.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B204721P1	Actuator spring.
	19A121419P1	Spacer.
	19A121418P1	Insulator.
		HANDSET HOOKSWITCH 19B204970G1
		- - - - - - - - - - SWITCHES - - - - - - - - - -
	19A121612P1	Hookswitch.
		- - - - - - - - - - - CABLES - - - - - - - - - - -
W1705	19B204731G1	Cable: approx 50 inches long.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P1715 thru P1719	4036634P2	Contact, electrical: sim to AMP 42429-2.

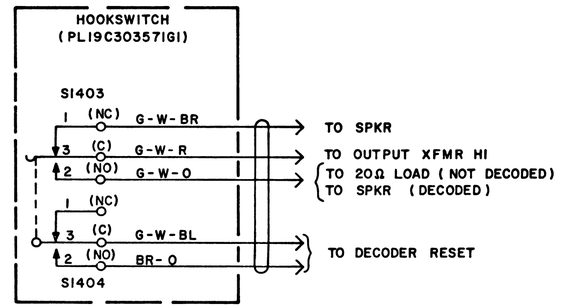
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SCHEMATIC DIAGRAM



(19B226365, Rev. 1)

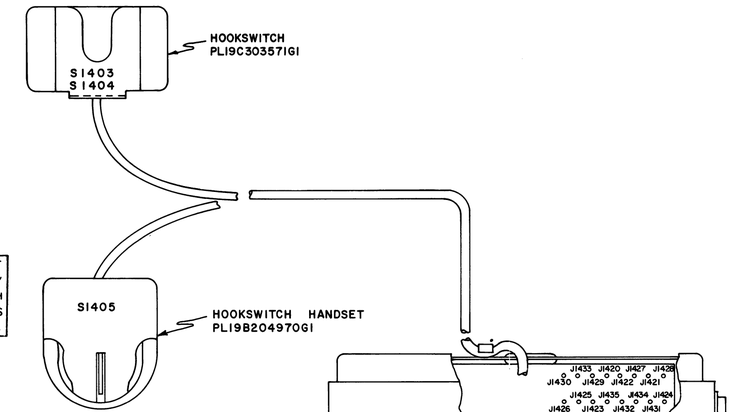
SCHEMATIC DIAGRAM



(19B226366, Rev. 1)

SERVICE SHEET

MICROPHONE/HANDSET



FOR APPLICATION OF HOOKSWITCH KIT PL19B204970 AND PL19C303571 TO MOBILE & AC STATION TYPE 99 DECODER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
PL19B204970G1	

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
PL19C303571G1	

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

CONNECTION CHART
HOOKSWITCH PL19C303571G1

FROM	TO	WIRE
S1403-1	J1420	G-W-BR
S1403-2	J1422	G-W-O
S1403-3	J1421	G-W-R
S1404-2	J1424	BR-O
S1404-3	J1423	G-W-BL

SAME AS PT 4 EXCEPT AS SHOWN IN CONNECTION CHART.

CONNECTION CHART
HOOKSWITCH PL19B204970G1

FROM	TO	WIRE
S1405-1	J1422	G-W-O
S1405-2	J1421	G-W-R
S1405-3	J1420	G-W-BR
S1405-5	J1423	G-W-BL
S1405-6	J1424	BR-O

INSTRUCTIONS

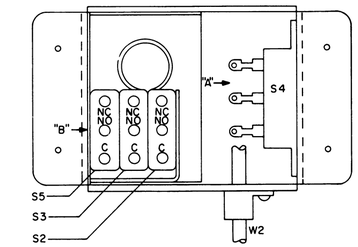
1. REMOVE DECODER FROM CASE.
2. REMOVE JUMPER BETWEEN J1423 & J1424.
3. ROUTE CABLE AS SHOWN AND CONNECT AS SHOWN IN CHART.
4. WHEN HOOKSWITCH HANDSET (19B204970G1) IS USED, CONNECT # 22 WHITE (2 INCHES LONG) WIRE FROM J701-12 TO J701-2, WHEN USED WITH 4EC59A CONTROL UNITS.

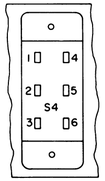
(19C311867, Rev. 3)

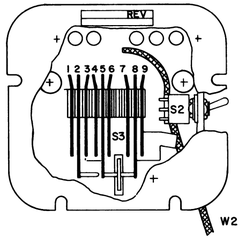
INSTALLATION DIAGRAM

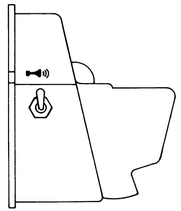
HANDSET/HOOKSWITCH, MOBILE & AC STATION TYPE 99 DECODER

OUTLINE DIAGRAM

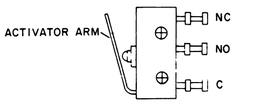






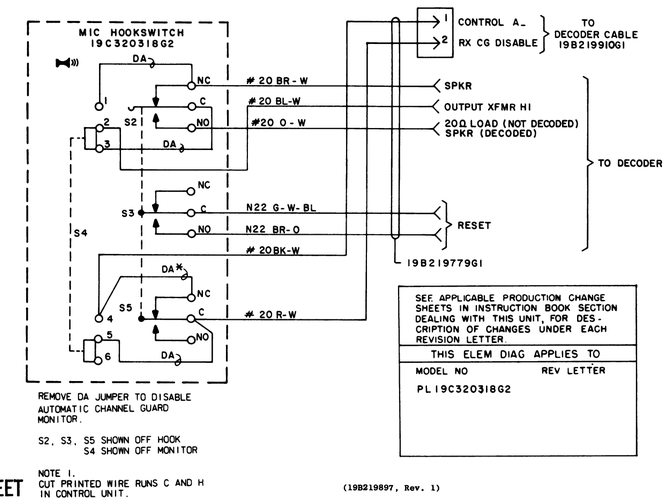


(19B226656, Rev. 0)



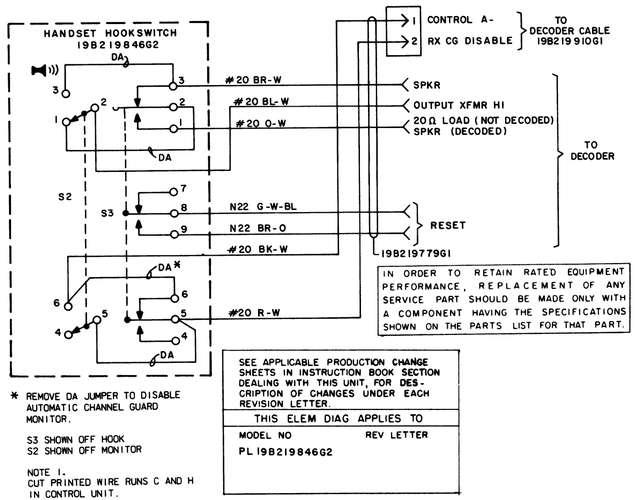
(19B226125, Rev. 1)

SCHEMATIC DIAGRAM



(19B219897, Rev. 1)

SCHEMATIC DIAGRAM



(19B219843, Rev. 1)

PARTS LIST

LBI-4741

MICROPHONE HOOKSWITCH
19C320318G2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S2 and S3	19A116676P1	Switch, sensitive: SPDT, 5 amp at 24 VDC or 5 amp at 250 VRMS; sim to Microswitch 11SM1-T2.
S4	19B219698G2	Slide: DPDT, 3 amp at 125 VAC, 2.2 amp at 14 VAC; sim to Switchcraft 46206LH. (S1 includes switch and housing).
S5	19A116676P1	Switch, sensitive: SPDT, 5 amp at 24 VDC or 5 amp at 250 VRMS; sim to Microswitch 11SM1-T2.
		- - - - - - - - - - CABLES - - - - - - - - - -
W2	19B219779G1	Cable: approx 50 inches long. Includes (5) 4036634P1 electrical contacts.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	19B219694P1	Base plate.
	N193P1410C	Tap screw: No. 8-18 x 5/8. (Secures base plate to mounting surface).
	7147223P2	Clip, loop. (External strain relief).
	19B201074P304	Tap screw, Phillips POZIDRIV®: No. 6-32 x 1/4. (Secures external strain relief).
	4029851P4	Cable clip; sim to Weckesser Co. 3/16-4-128. (Strain relief for W2).
	N80P9005C6	Machine screw: No. 4-40 x 5/16. (Secures cable clip).
	N404P11C6	Lockwasher: No. 4. (Used with internal cable clip).
	7141225P2	Hexnut: No. 4-40. (Used with internal cable clip).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

LBI4742A

HANDSET HOOKSWITCH
19B219846G2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S2	19A116677P6	Toggle: DPDT, 1 ma at 6 VDC; sim to C and K Components Series Type 7201G. (CHANNEL GUARD DISABLE).
S3	19A129585P2	Hookswitch, Handset: black, 3 form C contacts.
		- - - - - - - - - - CABLES - - - - - - - - - -
W2	19B219779G1	Cable: approx 50 inches long. Includes (5) 4036634P1 electrical contacts.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	N190P1312C	Tap screw, Phillips POZIDRIV: No. 6 x 3/4. (Secures lower housing to base plate).
	N84P13012C6	Machine screw, phillips: No. 6-32 x 3/4. (Secures upper housing to base plate).
	N84P15016C6	Machine screw, phillips: No. 8-32 x 1. (Secures bumpers).
	N101P1510P	Tap screw, phillips head: No. 8-15 x 5/8. (Secures plate to mounting surface).
	19B219852P1	Base plate.
	19A129586G1	Bumper, rubber.
	4029851P4	Cable clip; sim to Weckesser Co. 3/16-4-128. (Strain relief for W2).
	N80P9005C6	Machine screw: No. 4-40 x 5/16. (Secures cable clip).
	N404P11C6	Lockwasher: No. 4. (Used with cable clip).
	7141225P2	Hex nut: No. 4-40. (Used with cable clip).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

ADDENDUM #1 TO LBI4875B

UNIVERSAL TYPE 99 DECODER

(DF5035)

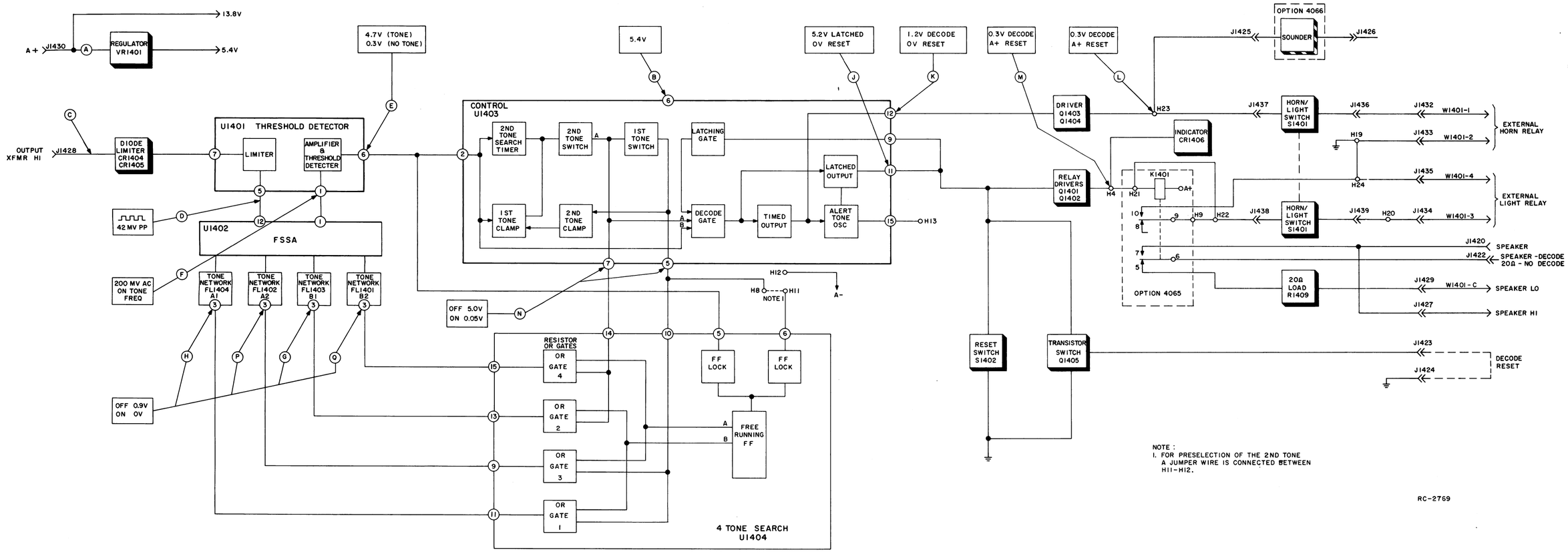
The following revision letter changes have been made to improve operation. The updated Schematic, Outline and Parts List are included in this addendum.

REV. B - Decoder Board 19C320658G1

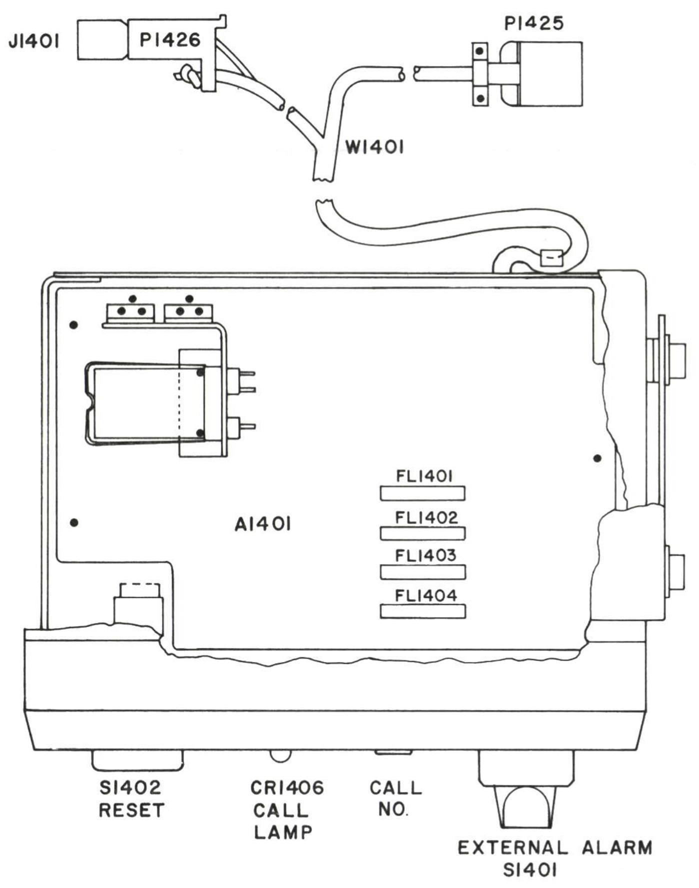
To improve performance in noisy vehicle electrical systems. Added C1419, C1420, CR1408, Q1406, R1416 and R1417.

REV. C - To improve performance in noisy vehicle electrical systems when used with external horn relay option. Added C1421 and R1418.

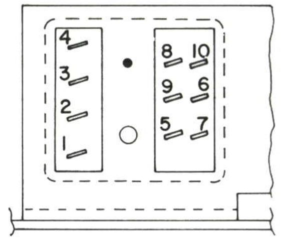
REV. D - To improve performance of internal sounder option and decrease sensitivity to vehicle system transients. Removed C1421 and R1418. Changed connection of A+ lead of C1419 to 5.4 Volt side of R1415.


13.8V
A+ J1430
REGULATOR VR1401
5.4V
4.7V (TONE) 0.3V (NO TONE)
5.4V
5.2V LATCHED 0V RESET
1.2V DECODE 0V RESET
0.3V DECODE A+ RESET
0.3V DECODE A+ RESET
OPTION 4066
SOUNDER
J1425
J1426
OUTPUT XFMR HI J1428
DIODE LIMITER CR1404 CR1405
U1401 THRESHOLD DETECTOR
LIMITER
AMPLIFIER & THRESHOLD DETECTER
CONTROL U1403
2ND TONE SEARCH TIMER
2ND TONE SWITCH
1ST TONE SWITCH
LATCHING GATE
1ST TONE CLAMP
2ND TONE CLAMP
DECODE GATE
TIMED OUTPUT
LATCHED OUTPUT
ALERT TONE OSC
H13
DRIVER Q1403 Q1404
INDICATOR CR1406
RELAY DRIVERS Q1401 Q1402
K1401
H4
H21
A+
H23
J1437
HORN/ LIGHT SWITCH S1401
J1436
J1432
W1401-1
EXTERNAL HORN RELAY
H19
J1433
W1401-2
J1435
W1401-4
H24
EXTERNAL LIGHT RELAY
42 MV PP
U1402
FSSA
H9
H22
J1438
J1439
H20
J1434
W1401-3
J1420
SPEAKER
J1422
SPEAKER -DECODE 20Ω - NO DECODE
200 MV AC ON TONE FREQ
TONE NETWORK FL1404 A1
TONE NETWORK FL1402 A2
TONE NETWORK FL1403 B1
TONE NETWORK FL1401 B2
H12
H8
H11
NOTE 1
A-
OPTION 4065
20Ω LOAD R1409
J1429
W1401-C
SPEAKER LO
J1427
SPEAKER HI
OFF 5.0V ON 0.05V
RESISTOR OR GATES
OR GATE 4
OR GATE 2
OR GATE 3
OR GATE 1
FF LOCK
FF LOCK
FREE RUNNING FF
RESET SWITCH S1402
TRANSISTOR SWITCH Q1405
J1423
J1424
DECODE RESET
OFF 0.9V ON 0V
4 TONE SEARCH U1404
NOTE :
1. FOR PRESELECTION OF THE 2ND TONE A JUMPER WIRE IS CONNECTED BETWEEN H11-H12.
RC-2769

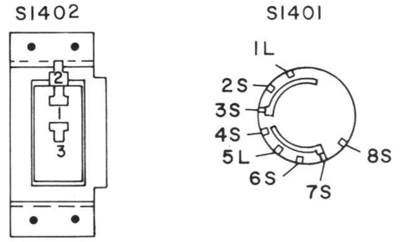
MOBILE DECODER



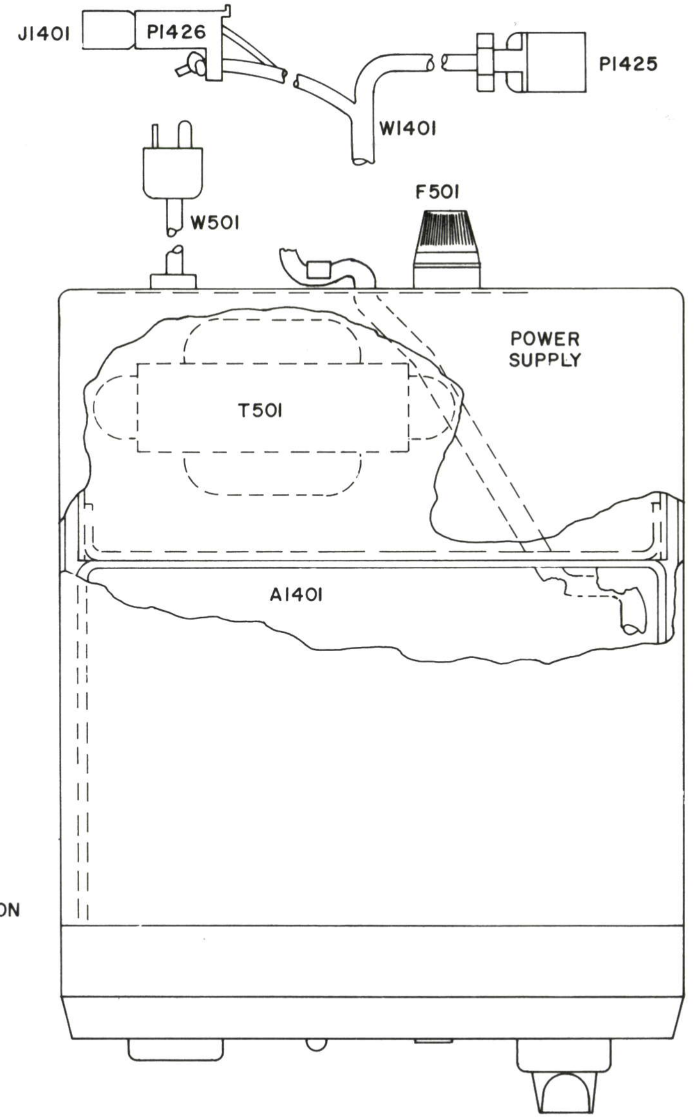
TERMINAL VIEW
XK1401



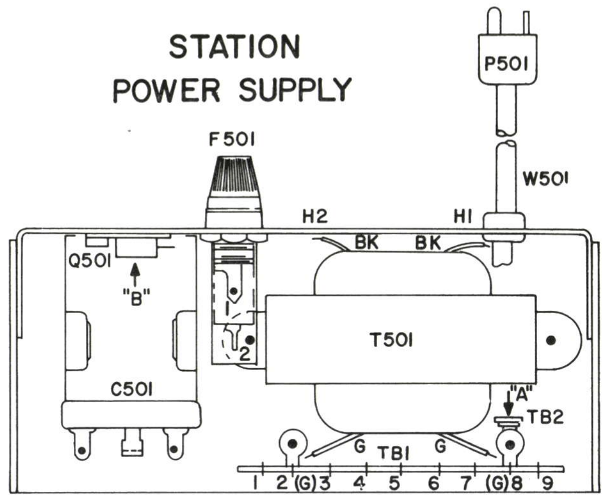
TERMINAL VIEW



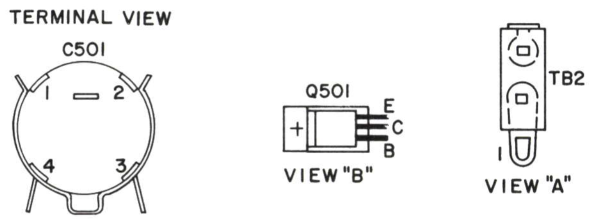
STATION DECODER



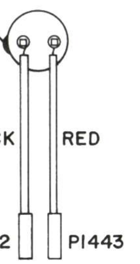
STATION POWER SUPPLY



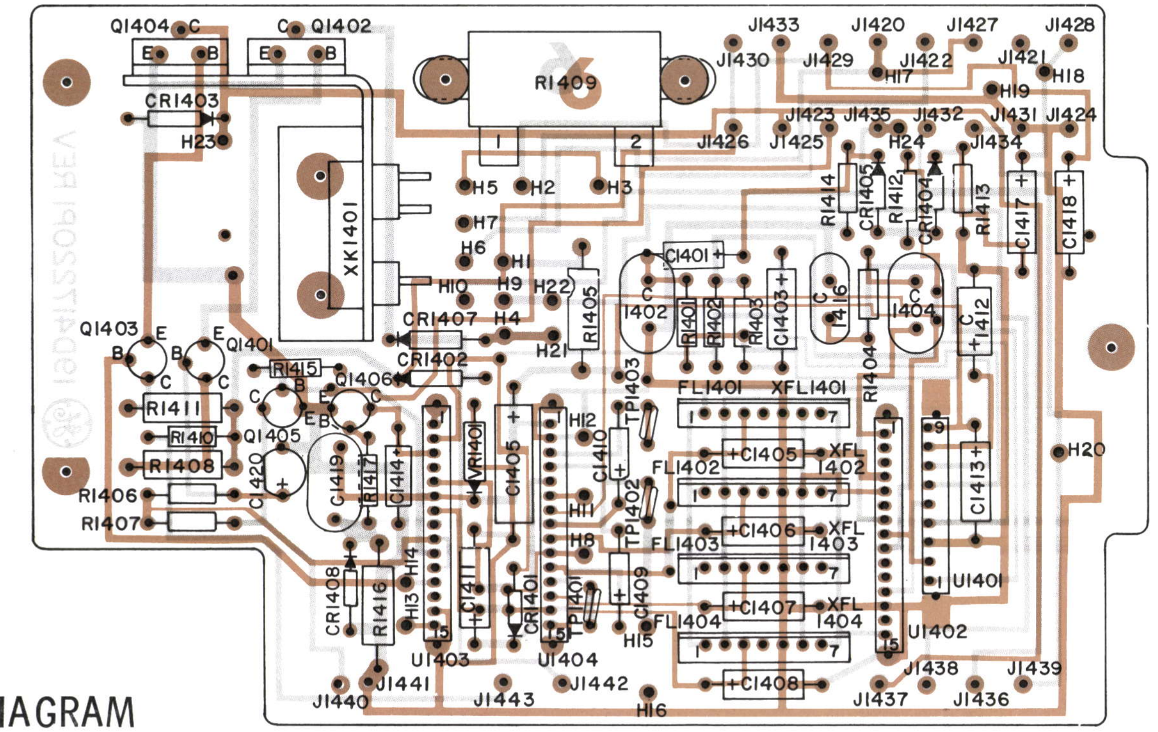
BOTTOM VIEW



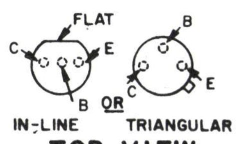
LEAD IDENTIFICATION
CR1406



A1401

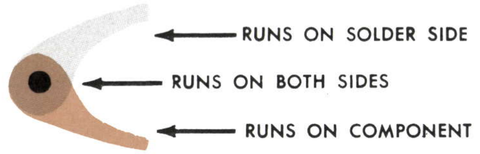


LEAD IDENTIFICATION FOR
Q1401, Q1403, Q1405 & Q1406



TOP VIEW

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.



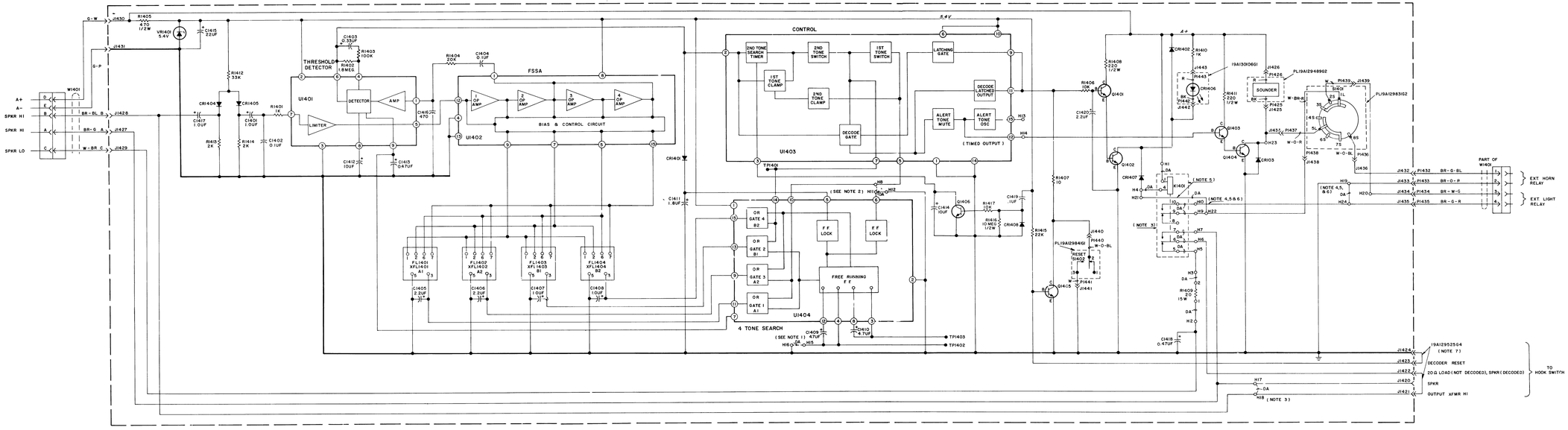
OPTION	CONNECTION REMOVED	CONNECTION ADDED	COMB. NO.
Basic Unit - 2 Tone (Mobile)	None	H15-H16	V22
Basic Unit - 4 Tone (Mobile)	None	None	V24
Basic Unit - 2 Tone (AC)	None	H15-H16 (See Option 4066)	V42
Basic Unit - 4 Tone (AC)	None	(See Option 4066)	V44
Option 4065 Speaker Muting	H17-H18 H21-H22 H19-H24	None	ANY
Option 4066 Sounder (Standard in AC Version)	None	Rd Wire-J1426 Bk Wire-J1425	V42 V44
Option 4092 Hookswitch for M.L. Mic. (Not for use with MASTR II)	J1421-J1422 J1423-J1424	None	ANY
Option 4093 Extension Cable	None	None	ANY
Option 4094 Hookswitch for Handset (Not for use with MASTR II)	J1421-J1422 J1423-J1424	None	ANY
Option 9023 M.L. Mic. and Hookswitch (MASTR II only)	J1421-J1422 J1423-J1424	None	ANY
Option 9025 Handset and Hookswitch (MASTR II only)	J1421-J1422 J1423-J1424	None	ANY

(19B226364, Rev. 5)

OUTLINE DIAGRAM

MOBILE AND STATION TYPE 99
TONE DECODERS

(19D423277, Rev. 5)
(19D417220, Sh. 2, Rev. 6)
(19D417220, Sh. 3, Rev. 6)



(19B622056, Rev. 11)

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED. RESISTANCE VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG = 1,000,000 OHMS. CAPACITOR VALUES IN MICROFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY PF=PICOFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DES-CRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO

MODEL NO.	REV LETTER
PLI9C3206586G1	D
PLI9D417257G1	

NOTES:

1. FOR TWO FREQUENCY OPERATION, "DA" WIRE JUMPER IS CONNECTED BETWEEN H15 AND H16.
2. WHEN 2ND TONE IS NOT PRESELECTED, A DA JUMPER IS CONNECTED BETWEEN H11 AND H12. WHEN 2ND TONE IS PRESELECTED, A DA JUMPER IS CONNECTED BETWEEN H11 AND H8.
3. FOR SPEAKER MUTING K1401 IS PRESENT AND A DA JUMPER BETWEEN H17 AND H18 IS REMOVED. FOR NO SPEAKER MUTING A DA JUMPER IS CONNECTED BETWEEN H17 AND H18. NOTE 5 ALSO APPLIES.
4. FOR A LATCHED RELAY DRIVER TRANSISTOR OUTPUT TO THE EXTERNAL LIGHT CONNECTION, DA JUMPERS ARE CONNECTED BETWEEN H21 AND H22 AND BETWEEN H19 AND H24.
5. FOR A LATCHED RELAY OUTPUT TO THE EXTERNAL LIGHT CONNECTION, K1401 IS PRESENT AND DA JUMPERS BETWEEN H21 AND H22 AND BETWEEN H19 AND H24 ARE REMOVED.
6. FOR A TIMED RELAY OUTPUT TO THE EXTERNAL LIGHT CONNECTION, K1401 IS PRESENT AND A DA JUMPER IS CONNECTED BETWEEN H21 AND H22. ARE REMOVED. A DA JUMPER BETWEEN K1401 - PIN 4 AND H23 IS REMOVED, AND A DA JUMPER IS CONNECTED BETWEEN K1401 - PIN 4 AND H23.
7. WHEN A HOOK SWITCH IS NOT USED, A JUMPER IS CONNECTED BETWEEN J1423 AND J1424 AND BETWEEN J1421 AND J1422.

SCHEMATIC DIAGRAM

MOBILE & STATION TYPE 99 TONE DECODERS

Issue 4

ADDENDUM TO LBI4875

PARTS LIST

LBI4876C

TYPE 99 DECODER 19D417257G1
AND
ASSOCIATED ASSEMBLIES

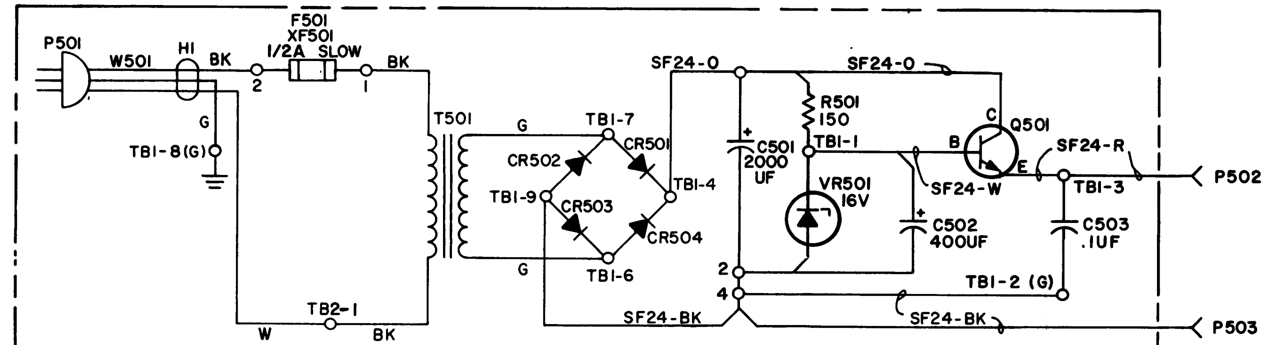
SYMBOL	GE PART NO.	DESCRIPTION
		TYPE 99 DECODER 19D417257G1
A1401		DECODER BOARD 19C320658G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1401	5496267P217	Tantalum: 1.0 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C1402	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C1403	5496267P227	Tantalum: 0.33 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C1404	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C1405 and C1406	5496267P213	Tantalum: 2.? µf ±10%, 20 VDCW; sim to Sprague Type 150D.
C1407 and C1408	5496267P217	Tantalum: 1.0 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C1409 and C1410	5491674P45	Tantalum: 4.7 µf ±10%, 6 VDCW; sim to Sprague Type 162D.
C1411*	19B200240P15	Tantalum: 1.8 µf ±5%, 20 VDCW.
		Earlier than REV A:
	5496267P213	Tantalum: 2.2 µf ±10%, 20 VDCW; sim to Sprague Type 150D.
C1412	5491674P40	Tantalum: 10 µf ±20%, 20 VDCW; sim to Sprague Type 162D.
C1413	5496267P228	Tantalum: 0.47 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C1414	5491674P37	Tantalum: 10 µf ±20%, 10 VDCW; sim to Sprague Type 162D.
C1415	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C1416	7489162P43	Silver mica: 470 pf ±5%, 300 VDCW; sim to Electro Motive Type DM-15.
C1417	5496267P217	Tantalum: 1.0 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C1418	5496267P228	Tantalum: 0.47 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C1419*	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW. Added by REV B.
C1420*	19A134202P7	Tantalum: 2.2 µf ±20%, 20 VDCW. Added by REV B.
C1421*	5496267P3	Tantalum: 150 µf ±20%, 6 VDCW; sim to Sprague Type 150D. Added by REV C. Deleted by REV D.
		- - - - - - - - - DIODES AND RECTIFIERS - - - - -
CR1401	19A115250P1	Silicon, fast recovery, 225 MA, 50 PIV.
CR1402 and CR1403	4037822P1	Silicon, 1000 MA, 400 PIV.
CR1404 and CR1405	19A115250P1	Silicon, fast recovery, 225 MA, 50 PIV.
CR1407	4037822P1	Silicon, 100 MA, 400 PIV.
CR1408*	19A115250P1	Silicon, fast recovery, 225 MA, 50 PIV. Added by REV B.
		- - - - - - - - - - TONE NETWORKS - - - - - - - - -
		NOTE: When reordering give GE Part Number and specify exact frequency needed.
FL1401 thru FL1404	19C320291G2	Hybrid: 517.5-997.5 Hz.
	19C320291G3	Hybrid: 288.5-1433.4 Hz.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1420 thru J1443	4033513P14	Contact, electrical: sim to Bead Chain R40-4AA.
		- - - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1401	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q1402	19A116118P1	Silicon, NPN.
Q1403	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q1404	19A116118P1	Silicon, NPN.
Q1405	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q1406*	19A115910P1	Silicon, NPN; sim to Type 2N3904. Added by REV B.
		- - - - - - - - - - - RESISTORS - - - - - - - - - -
R1401	3R152P102J	Composition: 1K ohms ±5%, 1/4 w.
R1402	3R152P185J	Composition: 1.8 megohm ±5%, 1/4 w.
R1403	3R152P104J	Composition: 100K ohms ±5%, 1/4 w.
R1404	3R152P203J	Composition: 20K ohms ±5%, 1/4 w.
R1405	3R77P471J	Composition: 470 ohms ±5%, 1/2 w.
R1406	3R152P103J	Composition: 10K ohms ±5%, 1/4 w.
R1407	3R152P100J	Composition: 10 ohms ±5%, 1/4 w.
R1408	3R77P221J	Composition: 220 ohms ±5%, 1/2 w.
R1409	5496941P24	Wirewound: 20 ohms ±5%, 15 w; sim to Tru-Ohm Type MOR-15.
R1410	3R152P102J	Composition: 1K ohms ±5%, 1/4 w.
R1411	3R77P221J	Composition: 220 ohms ±5%, 1/2 w.
R1412	3R152P333J	Composition: 33K ohms ±5%, 1/4 w.
R1413 and R1414	3R152P202J	Composition: 2K ohms ±5%, 1/4 w.
R1415	3R152P223J	Composition: 22K ohms ±5%, 1/4 w.
R1416*	3R77P106J	Composition: 10 megohms ±5%, 1/2 w. Added by REV B.
R1417*	3R152P103J	Composition: 10K ohms ±5%, 1/4 w. Added by REV B.
R1418*	3R152P622J	Composition: 6.2K ohms ±5%, 1/4 w. Added by REV C. Deleted by REV D.
		- - - - - - - - - - TEST POINTS - - - - - - - - - -
TP1401 thru TP1403	19A134552P1	Spring. (Test Point).
		- - - - - - - - - INTEGRATED CIRCUITS - - - - - -
U1401	19C320539G1	Threshold Detector Limiter.
U1402	19D417092G1	Selective Amplifier.
U1403	19D417098G1	Control.
U1404	19D417132G1	4 Tone Search.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - - -
VR1401	4036887P5	Zener: 500 mW, 5.4 v. nominal.
		- - - - - - - - - - - SOCKETS - - - - - - - - - - -
XF1401 THRU XF1404	19C320299G1	Includes:
	19D416714P1	Socket.
	19B219681P1	Contact.
XK1401	5491595P4	Relay: 10 contacts; sim to Allied Control 30054-1.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1406	19A130106G1	Diode, red light emitting.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1401		(Part of W1401).
		- - - - - - - - - - - - PLUGS - - - - - - - - - - -
P1424 thru P1435		(Part of W1401).
		- - - - - - - - - - - SWITCHES - - - - - - - - - -
S1401	19A129831G2	Rotary: 1 section, 2 poles, 3 positions, non-shorting contacts, 2 amps at 25 VDC or 1 amp at 110 VAC; sim to Oak Type A.
S1402	19A129841G1	Push: SPDT, 10 amp at 125 or 250 VAC; sim to Micro Switch 13DM1-B1.
		- - - - - - - - - - - CABLES - - - - - - - - - - -
W1401		CABLE ASSEMBLY 19B204739G1
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1401		Connector. Includes:
	5492497P24	Shell.
	5492497P1	Contact: sim to AMP 42485-1. (Quantity 4).
		- - - - - - - - - - - - PLUGS - - - - - - - - - - -
P1425	7489183P10	Plug: 9 contacts rated at 7.5 amps max; sim to Winchester M9P-LS-H19C.
P1426		Connector. Includes:
	5492497P14	Shell.
	5492497P1	Contact: sim to AMP 42485-1. (Quantity 4).
P1427 thru P1435	4036634P1	Contact, electrical; sim to AMP 42428-2.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A116022P1	Insulator, bushing. (Used with Q1402 & Q1404).
	19A116023P3	Insulator, plate. (Used with Q1402 & Q1404).
	19A130013P1	Insulator. (Used with U1401).
	19C311848G2	Chassis.
	19B205054P2	Front cap.
	19A121880P1	Support. (S1402).
	19A116677P1	Bushing. (CR1406).
	NP276470	Nameplate.
	19B205111G2	Knob. (S1401).
	19B209209P308	Tap screw, Phillips POZIDRIV®: No. 6-32 x 1/2. (Secures Front Cap to Chassis).
	19B209209P204	Tap screw, Phillips POZIDRIV®: No. 4-40 x 1/4. (Secures S1402 support).
	7115130P9	Lockwasher, internal tooth. (Secures S1401).
	7165075P2	Hex nut, brass: thd. size No. 3/8. (Secures S1401).
		ASSOCIATED ASSEMBLIES
		SOUNDER OPTION 19A129489G2
		- - - - - - - - - - LOUDSPEAKERS - - - - - - - - -
LS1	19A116090P1	Permanent magnet: 2.00 inch, 8 ohms ±10% voice coil imp, 450 Hz ±112 Hz resonant; freq range 400 to 3000 Hz.
		SOUNDER BOARD 19C320785G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C2 and C3	5491674P44	Tantalum: 2.2 µf 20%, 15 VDCW; sim to Sprague Type 162D.
C4	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1 and CR2	19A115250P1	Silicon, fast recovery, 225 MA, 50 PIV.
		- - - - - - - - - - - TRANSISTORS - - - - - - - -
Q1	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q2	19A115562P2	Silicon, PNP.
Q3 and Q4	19A115910P1	Silicon, NPN; sim to Type 2N3904.
		- - - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R152P473J	Composition: 47K ohms ±5%, 1/4 w.
R2	3R152P182J	Composition: 1.8K ohms ±5%, 1/4 w.
R3	3R152P223J	Composition: 22K ohms ±5%, 1/4 w.
R4 and R5	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R6	3R152P223J	Composition: 22K ohms ±5%, 1/4 w.
R7	3R77P470J	Composition: 47 ohms ±5%, 1/2 w.
R8	3R152P331J	Composition: 330 ohms ±5%, 1/4 w.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - -
	4036634P1	Contact, electrical; sim to AMP 42428-2. (Hung in wiring from H1 and H2).
	19B219776P1	Insulator. (Located under component board).
	4036555P1	Insulator, washer: nylon. (Used with Q2).
	N404P13C6	Lockwasher: No. 6. (Secures Sounder board to support).
	N80P13010C6	Machine screw: No. 6-32 x 5/8. (Secures Sounder board to support).
	7141225P3	Hex nut: No. 6-32. (Secures Sounder board to support).
	19B204583G2	Hinge. (Located nearest control face).
	19B204583G3	Hinge. (Located away from control face).
	19B209209P305	Tap screw, Phillips Pozidriv®: No. 6-32 x 5/16. (Secures hinges to decoder).
	19B201074P205	Tap screw, Phillips POZIDRIV®: No. 4-40 x 5/16. (Secures Sounder board to hingers).
	19C320662P1	Support. (Sounder Kit locates on this support).
	7150186P109	Spacer: No. 6-1/8. (Located under Sounder board).
	N80P13005C6	Screw: No. 6-32 x 5/16. (Secures Sounder option to decoder case).
	NP243580	Decal, Call Numbers.
		STATION POWER SUPPLY 19C311855G1
		- - - - - - - - - - - CAPACITORS - - - - - - - - -
C501*	7476442P23	Electrolytic, twist-prong: 2000 µf +250-10%, 50 VDCW; sim to PR Mallory FP070A.
		In REV A and earlier:
	7770994P28	Electrolytic: 500-500 µf -10% + 200%, 25-25 VDCW; sim to Mallory Type WP.
C502*	19A115680P24	Electrolytic: 400 µf +150% -10%, 18 VDCW; sim to Mallory Type TTX. Added by REV B.
C503*	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW. Added by REV B.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR501 thru CR504	4037822P1	Silicon, 1000 MA, 400 PIV.
		- - - - - - - - - - - - FUSES - - - - - - - - - - -
F501*	7487942P3	Slow blowing: 1/2 amp at 250 v; sim to Bussmann MDL-1/2.
		In REV A and earlier:
	7487942P1	Slow blowing: 1/4 amp at 250 v; sim to Bussmann MDL-1/4.
		- - - - - - - - - - - PLUGS - - - - - - - - - -
P502 and P503	4036634P1	Contact, electrical; sim to AMP 42428-2.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q501*	19A116742P1	Silicon, NPN.
		In REV B:
	19A116118P1	Silicon, NPN. Added by REV B.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R501*	3R152P151J	Composition: 150 ohms ±5%, 1/4 w.
		In REV B:
	3R77P221K	Composition: 220 ohms ±10%, 1/2 w.
		In REV A and earlier:
	5496941P23	Wirewound: 16 ohms ±5%, 15 w; sim to Tru-Ohm Type MOR-15.
		- - - - - - - - - TRANSFORMERS - - - - - - - - - -
T501	5493743P1	Power: step down: Pri: 117 v, 50/60 Hz, Sec 1: 12.6 v ±3%, 2 amps.
		- - - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1	7775500P25	Phen: 7 insulated, 2 grounded terminals.
TB2*	7775500P44	Phen: 2 terminals. Added by REV B.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR501*	19A115528P6	Zener: 1 watt, 17.6 v max. Added by REV B.
		- - - - - - - - - - - CABLES - - - - - - - - - -
W501	19A134567P1	Power: 3 conductor, approx 6 feet long.
		- - - - - - - - - - - SOCKETS - - - - - - - - - -
XF501	19B209005P1	Fuseholder, post type, phen: 15 amps at 250 v; sim to Littelfuse 342012.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A134016P1	Insulator, bushing. (Used with Q501).
	19A116023P1	Insulator, plate. (Used with Q501).
	19A116768P8	Strain relief. (Used with W501).
		SPEAKER MUTE KIT 19A130158G1
	5491595P12	Relay, armature: 1.5 w operating, 520 ohms ±15% coil res, 2 form C contacts; sim to Allied Control T154-X-186.
	5491595P8	Retainer: spring; sim to Allied Control 30040-1.

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - Power Supply 19C311855.
Incorporated in initial shipment.

REV. B - To improve operation. Changed C501, F501 and R501. Added C502, C503, Q501 and VR1.

Old Schematic was:



REV. C - To improve regulation. Changed Q501 and R501.

REV. A - Decoder Board 19C320658G1.
To improve operation. Changed C1411.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES